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CREEP COMPLIANCE TEST FOR ASPHALTIC CONCRETE

COMPUTER PROGRAM DOCUMENTATION and USER'S GUIDE

MATERIALS INFORMATION
ENGINEERING MATERIALS OFFICE

CREEP COMPLIANCE TEST FOR ASPHALTIC CONCRETE
COMPUTER PROGRAM

Part 1: DOCUMENTATION
Part 2: USER'S GUIDE

by

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TECHNICAL REPORT DOCUMENTATION PAGE

CREEP COMPLIANCE TEST for ASPHALTIC CONCRETE
COMPUTER PROGRAM DOCUMENTATION

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Abstract:

A computer application program has been developed to automate laboratory testing of bituminous mixtures for *creep compliance* based mainly on a procedure developed by the U.S. Federal Highway Administration. The program was designed and written for the specific environment of the servohydraulic Materials Test System (MTS Model 810) which includes a series 468 Test Processor, a Digital PDP-11/23-Plus microcomputer and other peripheral devices.

After initial test setup, the user enters information required by the program and triggers the testing routine. Subsequently, the program generates test loadings, controls loading patterns as specified by the procedure, performs data acquisition, processes the acquired data, calculates test results, presents the results in tabular and graphical formats, and finally saves the results to a disk file. The program enables the test to be run to completion unattended.

The first part of this report documents the concept, the control functions used, and the most essential design particulars of the program. Appendices contain information which enables programmers to make changes to the program if necessary.

The second part of the report is a "User's Guide" providing the information required by a knowledgeable technician to operate the program and complete a creep compliance test. A listing of the control program in MTS BASIC is also provided.

Résumé :

Un programme d'application informatisé a été élaboré, en s'inspirant en grande partie d'une méthode mise au point par la Federal Highway Administration, pour automatiser les tests de conformité du fluage des mélanges asphaltiques. Le programme a été conçu et rédigé pour le système d'essai de matériaux MTS, qui comporte un processeur d'essai de série 468, un micro-ordinateur Digital PDP-11/23 Plus et d'autres unités périphériques.

Après l'installation initiale, l'utilisateur entre les renseignements nécessaires et amorce le programme d'essai. Le programme procède alors aux chargements des essais, vérifie les modèles de chargement selon la procédure, acquiert et traite des données, calcule les résultats des essais et les présente sous forme de tableaux et de graphiques, puis sauvegarde le tout sur disquette. Le programme permet d'effectuer les essais sans avoir à rester sur place.

La première partie du présent rapport décrit le concept, les fonctions utilisées et les principales caractéristiques de conception du programme. Les annexes contiennent des renseignements qui permettront aux programmeurs de modifier le programme au besoin.

On trouvera en seconde partie du rapport un guide de l'utilisateur contenant des renseignements que les techniciens trouveront utiles pour utiliser le programme et effectuer un test de conformité du fluage. La seconde partie contient également une liste du programme de gestion en MTS BASIC.

Keywords: **Computer program, creep, creep compliance, asphalt mixes, laboratory testing, data acquisition, program documentation.**

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- D - EXAMPLE OF PROGRAM INPUT AND OUTPUT

PART 1

DOCUMENTATION

1. INTRODUCTION

The creep compliance test measures the response of materials, over time, under different load and environmental conditions. The results are therefore expressed in terms of time-dependent deformation of the viscoelastic characteristics of a material. The results provide the necessary information for evaluation of rutting potential of materials as inputs to a computer predictive model called VESYS-3M (for more details see Engineering Materials Office report MI-147, Ministry of Transportation, Ontario).

The equipment set up in the Ministry Bituminous Evaluation Laboratory, consisting of the servohydraulic MTS testware and the Digital PDP-11 computer for data acquisition, lends itself to complete automation and computerized control of materials testing. A series of software is therefore written to fully automate the testing process; the program documented here forms part of this series and is for the creep compliance test. The program utilizes the MTS 773 Series high-level interpreted programming tool for supporting a multi-user environment. The program was first run in January 1988.

The test procedure is based on the method suggested by the U.S. Federal Highway Administration in a report FHWA-RD-77-154. Some modifications to the procedure has been made by the Evaluation Laboratory. For example, specimen preconditioning has been changed and the cycles of dynamic loading were reduced from 100,000 to 10,000 cycles. It is anticipated that further changes to this document may be necessary if the Strategic Highway Research Program (SHRP) procedure turns out to be different.

This report provides a brief outline of the test and details the computer software program for the test in two parts, *Part 1 - Program Documentation*, and *Part 2 - User's Guide*.

2. TEST OUTLINE

A complete description of the test procedures can be found in the "Bituminous Material Characterization Manual" published previously by Engineering Materials Office, MTO, in 1987. The following briefly outlines what is involved in the test:

A cylindrical specimen with a minimum diameter of 101.6 mm and height-to-diameter ratio of 2:1, is placed in the loading apparatus and conditioned until the specified test temperature is reached. The end surfaces of the cylindrical specimen must be kept parallel and flat, and perpendicular to the vertical axis of the specimen.

A temperature cabinet is used to control the test temperature. The specimen is preconditioned with two test loads held constant for 10 minutes each and then with a ramp loading-unloading sequence for 20 minutes. The specimen is maintained at a rest period until a predetermined partial recovery of the deformation has taken place.

After the preconditioning, the specimen is loaded with compressive static loads generated sequentially at specified time intervals of 0.1, 1, 10, 100, and 1,000 s. A repeated (dynamic) loading of 10,000 haversine cycles is then applied and followed by a rest period of 15 minutes.

The program records the permanent deformation of the specimen as well as the accumulated deformation measured between two pairs of points in a plane parallel to the vertical axis of the specimen. The overall deformation is checked during the test against the specified limiting strain value to ensure it is not exceeded. Also recorded is the deformation amplitude at the 200th load cycle in haversine loading. The acquired data are used to compute all intermediate and final test results. The computed information is presented in both tabular and graphical formats for analysis by the user.

The results reported are:

- creep compliance within 1000 s static loading,
- parameters μ (mu) and α (alpha) derived from both the static and dynamic loading.

3. PROGRAM PREREQUISITES AND LIMITATIONS

3.1. MINIMUM HARDWARE AND INSTRUMENTATION REQUIREMENTS

A microcomputer PDP-11/23-PLUS or LSI-11/23, a mass storage device (min. 10 MB), a system controlling terminal VT240 and MTS 468.10 test processor including a micro segment generator are involved.

The test requires two capping endplates and guiding rods for ensuring uniform distribution of loads over the specimen cross-section. The load is transmitted to the end plates directly over the specimen using the MTS loading frame arrangement as described in the manual mentioned in section 2 above.

A properly calibrated instrument (e.g. extensometer, LVDT) for precise measurement of vertical strain of the specimen is required. All instruments attached to the specimen must be locked in place and seated firmly during the whole test duration, especially during the dynamic part of the test. The load controller range cartridge should be selected at the mid-range of the test load. The range of stroke controller cartridge used in the test and the range of any LVDT or extensometer employed should be kept as small as possible for greater resolution.

3.2. TEST ASSUMPTIONS

In order for the program to function properly and to produce repeatable results, the following assumptions are made:

- the specimen is regular in shape, uniform in composition and structurally coherent;
- test temperature is constant for the duration of the test;
- the specimen is loaded uniformly over its end surfaces and the load is applied uniaxially throughout the test;

- the total vertical deformation of the specimen is kept below the limiting value such that no permanent structural damage is incurred during the test; i.e. specimen deformation remains recoverable;
- the "end-effect" of a specimen is considered negligible for the purpose of calculating vertical strain, and the vertical displacement (deformation) is measured between two planes perpendicular to the vertical axis of the specimen.

3.3. LIMITATIONS

The program can be used by technicians having a good knowledge of the test setup and testing procedure.

The limitations which pertain to this program are those inherited from the test controlling hardware (e.g. range cartridges, controlled temperature cabinet, extensometers). However, the program can accommodate a wide range of loads and displacements which could occur in testing viscoelastic materials.

3.4. SUPPLEMENTAL INFORMATION

The duration of execution time for the test depends largely on the waveform used in dynamic loading and, to lesser extent, on other parameters, such as timing sequences specified for specimen preconditioning and static loading. For a load cycle lasting one second and a rebound time of one hour following the preconditioning loading, the execution time is about 5.5 hours. This is not including the time needed for test setup and stabilizing to test temperatures.

The program was designed primarily for testing asphalt mixes. However, it could be used for testing other viscoelastic materials at similar test loading patterns.

4. PROGRAM CONTROL FUNCTIONS

4.1. LOADING GENERATION MODEL

A compression is generated in the test specimen by using multiple buffered functions such as **FGARB** and **FGRAMP** under LOAD control. The functions are queued and executed in the specified order at predetermined time intervals. The loading sequence and its timing is presented in Appendix B.

4.2. CONTROL PROCESS

The test is automatically suspended in the event that a strain exceeds the limiting value set for the test specifications until further intervention by the operator. However, the limits apply only to the preconditioning and incremental static loading test and not to the

haversine dynamic loading. When testing reaches the dynamic loading stage, the test is complete, even though the preset strain limit could be somewhat exceeded.

At the end of preconditioning, the loading sequence is halted using the FGHOLDEND function. The system waits for one hour and then resumes automatically. Sometimes, especially at low test temperatures, this waiting period can be quite long. In this case, the operator has the option of stopping the pause by following the instruction displayed on the screen.

An automatic shutdown of the MTS electro-hydraulic system is made possible within the program. This feature enables shutdown of a test when it is not attended to after normal working hours. When the test is completed, the program will wait for half an hour for an operator's intervention. If no specific inputs are received, the program will save the results and shut down the system by clearing a specified system channel.

5. IN-LINE DATA ACQUISITION AND PROCESSING

Three data acquisition processes are activated at a specified time during the test as shown in the table below.

PROCESS NO.	PROCESS ID.	ACTION PERFORMED	MASTER CHANNEL
0	ADBURST	Detects and stores in array S1(,) amplitude levels at the specified channel and sampling frequency. When in operation, it suspends all other data acquisition processes. ***NOTE: This process is triggered by a buffered function generating 0.1 s incremental loading and lasts for about 0.3 s.***	C
1	ADRMIN	Detects and stores in an array R1(,) the running minimum signal level reached at the specified master channel. This process is started only after the 200th cycle is completed during haversine (dynamic) loading. It is stopped immediately after the 202th cycle has been completed.	3
2	ADRMAX	The same as process No. 1 but detects and stores in array R2(,) the running maximum signal level.	3

NOTE

Although the whole process is controlled automatically, the operator can interrupt the program at some points in the test when justified. However, the controlling processor is very sensitive to external interference and this can give rise to inconsistent results or even destabilize the system during the test. Such interference could be caused by an accidental touching of the instrumentation. Thus, proper caution and some protective measures may be necessary to ensure undisturbed testing and validity of the results.

Some additional data on channels No. 1 and C are collected using an immediate detection function. They are needed at certain specified points in the test for real-time test control and for calculation of test results. These points - as indicated in the Appendix B with shadowed rectangular boxes - are:

- just before the first conditioning loading (S4,S5);
- during the specimen relaxation period after conditioning and just before the 0.1 s incremental loading (F0,A7);
- before the 1 s incremental loading, at the end of a specified relaxation period (N1,A1);
- before the 10 s incremental loading, at the end of a specified relaxation time (N2,A2);
- before the 100 s incremental loading, at the end of a specified relaxation time (N3,A3);
- before the 1000 s incremental loading, at the end of a relaxation period (N4,A4);
- at 0.033, 0.1, 0.3, 0.9, 2.7, 8.1, 24.3, 72.9, 218.7, 1000 s during the 1000 s loading (B2(i),-B1(i));
- at every check of the function generation status during incremental loading (B8);
- before the repeated haversine loading, at the end of a relaxation period (N6,A5);
- just before the start of dynamic haversine loading (A9,F1);
- after the completed haversine cycles: 1,10,100,1000,10000,10010 (H1(i),D1(i)); and
- at the end of test, after the 900 s holding period (D3,D4).

Processing of test data should not be done during the test because the computer is dedicated to keeping track of event timing, data conversion (binary to engineering), controlling displays and collecting required data. All calculations are performed after completion of the test, when required data are available.

6. CALCULATIONS

The following computations are performed using the data acquired from the test. The meaning of all symbols used in these equations is explained under description of variables. All stroke values are in mm, and all strain values are in microstrains.

$A_i = (A_i - F0) \times A0$

Stroke due to incremental static loading (relative to the stroke recorded just before the start of the incremental loading) (A1 ÷ A5).

$N_i = N_i \times Z3 - D0$

Strain due to incremental static loading (relative to the strain recorded just before the start of the incremental loading) (N1 ÷ N4, N6).

$N_i = N_i \times Z3 - D0$

Stroke and strain during 1000 s static loading (relative to the stroke/strain recorded prior to the start of 1000 s loading).

$D7(i) = B2(i) / L2$

Creep compliance at specified intervals during the 1000 s loading, m²/MN.

$B1(i) = B1(i) - I4$
$B2(i) = B2(i) - A8$

Accumulated "permanent" deformation (stroke) and strain due to haversine dynamic loading.

$D3 = D3 - F1$
$D4 = D4 - A9$

Total accumulated "permanent" deformation (stroke) due to both incremental static and haversine dynamic loading.

$D1(i) = D1(i) \times A0 - F1$
$H1(i) = H1(i) \times Z3 - A9$

Accumulated "permanent" deformation (stroke) and strain during the haversine dynamic loading.

$S2(i) = S2(i) \times M1 \times Z1$

Strain values picked up at 0.1 s incremental static loading.

$$P8 = \frac{P2}{5} - P7 \times \frac{P1}{5}; \qquad P7 = \frac{P5}{P6}, \qquad \textit{where:}$$

$$P1 = \sum_{i=1}^{c} (c-1) \qquad P2 = \sum_{i=1}^{c} \log B7(c)$$

$$P3 = \sum_{i=1}^{c} (c-1)^2 \qquad P4 = \sum_{i=1}^{c} (c-1) \times \log B7(c)$$

$$P5 = P4 - P1 \times \frac{P2}{5} \qquad P6 = P3 - \frac{P1^2}{5}$$

Parameters of a best-fit straight line through the points of accumulated strain during incremental static loading: P7 - slope, P8 - y-intercept.

$L9 = 1 - P7$
$L8 = P8 \times P7 / F7$

ALPHA(L9) and MU(L8) parameters resulting from static incremental loading.

$$G8=\frac{G2}{5}-G7\times\frac{G1}{5};\qquad G7=\frac{G5}{G6};\qquad \text{where:}$$

$$G1=\sum_{i=1}^{c}(c-1)\qquad G2=\sum_{i=1}^{c}\log H1(c)$$

$$G3=\sum_{i=1}^{c}(c-1)^2\qquad G4=\sum_{i=1}^{c}(c-1)\times\log H1(c)$$

$$G5=G4-G1\times\frac{G2}{5}\qquad G6=G3-\frac{G1^2}{5}$$

Parameters of a best-fit straight line through the points of accumulated strain during haversine dynamic loading: G7 - slope, G8 - y-intercept.

```
F9 = 1 - G7
F8 = G8 x G7 / F7
```

ALPHA(F9) and MU(F8) parameters resulting from haversine dynamic loading.

7. HARD DISK STORAGE

Apart from getting a hard copy of all test results immediately after the completion of a test, valid results can also be saved in a file on hard disk. Select 'SAVE TEST RESULTS' item from the test menu to write the results to a disk. The name of the file is assigned automatically with an appropriate message confirming the name of the file. Sometimes a message 'TEST RESULTS ARE SAVED ALREADY!' is displayed and then the program returns to the test menu. This message appears when an unattended test is completed. The test results are saved automatically when the parameter MU resulting from the test lies within the limit of 0 and 1. Otherwise, the results are not saved when an unattended test has been completed as they are considered invalid.

Normally, the data items listed below are saved for each single creep compliance test.

1__J$(5)	Test identification code
2__T4	Consecutive number of the creep test results about to be saved
3__D$	The system date returned by DAT$ function (DD-MM-YY)
4__J$(2)	Specimen identification code
5__J$(3)	Date of the sample (sampling or preparation)
6__J$(4)	Mix design identification code
7__J$(6)	Test specimen height, mm
8__J$(7)	Test specimen diameter, mm
9__J$(1)	Pavement sample identification code
10__J$(8)	Test specimen mass, kg
11__J$(9)	Distance from pavement edge/curb, m
12__L$(7)	Load calibration factor, N/V

13__L$(6)	Stroke calibration factor, mm/V
14__L$(8)	Strain calibration factor, mm/V
15__???	0.0 (Reserved)
16__L$(5)	Test temperature, °C
17__L$(10)	Test humidity, %
18__Z6	Compressive load applied in the test, N
19__L$(3)+L$(4)	Duration of a single dynamic loading cycle, s
20__L$(3)	Load pulse duration in dynamic loading, s
21__L$(9)	Spacing between the LVDT clamps, mm
22__D2	Strain amplitude (max-min) at 200th cycle of dynamic loading, μstrains
23__D5	Total 'permanent' deformation due to the test, mm
24__D6	Total 'permanent' strain due to the test, μstrains
25__D7(i)	Creep compliance (ten values) during the 1000 s static loading, m^2/MN
35__F8	ALPHA parameter calculated for the static loading series
36__L8	ALPHA parameter calculated for the dynamic loading
37__F9	GNU parameter calculated for the static loading series
38__L9	GNU parameter calculated for the dynamic loading
39__N1 ÷ N4	'Permanent' strain after 0.1, 1, 10, 100 s, respectively, of static incremental loading, μstrains
43__N6	'Permanent' strain after 0.1, 1, 10, 100 s, respectively, of static incremental loading, μstrains
44__B2(i)	Strain (ten values) during the 1000 s static loading (zero at the start of 1000 s period), μstrains
54__D3	'Permanent' deformation (stroke) due to the dynamic loading, mm
55__D4	'Permanent' strain due to the dynamic loading, μstrains
56__H1(i)	Strain (six values) during the dynamic part of the test (zero just before the start of dynamic loading), μstrains
62__M4$	NOTES entered by the user in the Test Report (four strings)

The end of file is marked with '{(0)}' string.

8. INTERPRETATION OF PROGRAM OUTPUT

With better control of test set-up and testing conditions, higher reliabilities of test results are obtained. If the program output - including all screen displays, plotted graphs, tables of results - does not look orderly, and increments in stroke, strain values during both the static and dynamic stages are irregular, then it is highly probable the test was not carried out properly and the results are not correct. It is advisable that a hard copy of the results

be obtained immediately after the test for review, while all the details of the test are fresh in the mind of the operator and the data can be retrieved from the computer memory.

The results of a single creep test should always be interpreted with proper care on the basis of past experience with similar type of mixes, under the same test conditions..

Conclusions about mix creep characteristics should be made only when satisfactory repeatable results are obtained.

9. COMMON PROBLEMS AND TROUBLESHOOTING

The creep compliance test procedure is a very complex because of the load generation sequence. Many loading patterns can be arbitrarily set for a test because they are not properly defined in the test specifications. Each one of them can make a difference in the results. Due to lack of experience with the test, it is not possible to list all potential problems; nevertheless, the following are dealt with in the program:

a) The amount of strain/stroke measured during incremental static loading does not increase consistently with the expected increase in loading time increment.

- **Several factors could be responsible for the error, the most common ones are:**
  - **the load is not transferred to the specimen uniformly at the end-plates;**
  - **the load and/or the end-plates are not centred/aligned properly in relation to the vertical axis of the specimen;**
  - **the end-plates are not being kept perpendicular to the vertical axis of the specimen during testing.**

b) The amount of strain/stroke measured during dynamic loading does not increase consistently with the number of loading cycles.

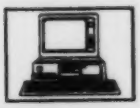
- **In addition to the factors listed above, this can be caused by some undetected displacement (slippage) of clamps supporting the LVDTs (or other sensors) used for strain measurements.**
- **The bouncing effect at the end-plate could cause inconsistent instrument readings.**
- **Sometimes, it could be caused by the structural damage resulted from excessive permanent deformations.**

c) The stroke and/or strain values drop gradually to zero during the test.

- **This could be a result of loosing control of the load. The MTS servo-hydraulic system becomes unstable (due to saturation of the load rate stabilization circuits).**

PART 2

USER'S GUIDE



10. DESCRIPTION OF TEST MENU ITEMS

To ensure full data integrity, the listed menu items must be accessed sequentially, starting from item No. 1. Also, it is recommended that exit to the program should be made together with a new load before starting another creep test.

① **IDENTIFY SAMPLE**

Accepts data entry for sample identification and description.

② **DETERMINE TEST SPECS**

Accepts data entry for test specifications.

③ **RUN THE TEST**

Invokes the program procedure for engaging the MTS servo-hydraulic hardware and starts an automatic test process, including load function generation, data acquisition and all required real-time data processing.

④ **PLOT GRAPHS**

Presents test results in a graphical format (four screens).

⑤ **LIST ACQUIRED DATA**

Presents processed data and all test results in a tabular form (formatted in three screens).

⑥ **PRINT TEST REPORT**

Displays the summary of test results in a formatted screen.

⑦ **SAVE TEST RESULTS**

Saves the essential test results to a disk file.

⑧ **QUIT THE PROGRAM**

Exits the program. Testing information remains accessible so long as no new program is loaded, otherwise the system will not shut down.

11. INSTRUCTIONS FOR THE USER'S INPUT

11.1. GENERAL

- To quit data entry at any time - type ? + ↵ instead of a normal required entry (e.g. a number). The program will return to the menu screen.
- To correct any single data item - follow on-screen instructions given after completing the data entry for a current data entry screen.
- To change the whole set of entered data, or major part of it - recall the relevant data entry screen and enter your correct data.
- To clear all data variables in computer memory - exit the program and load it anew.

There are two steps in data input to the program:

❒ sample identification and description,

❒ test specifications.

11.2. "IDENTIFY SAMPLE" SCREEN

Entries 1 through 5 are predetermined by the formats as defined in database application. They should be strictly followed to ensure compatibility with the database. The meaning of symbols in the formats shown in the appendix is given in the report entitled **"***SOFTWARE FOR AUTOMATED TESTING OF ASPHALT MIXES. Documentation and Guide***"**.

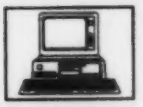
The next three items (6,7,8) characterize the size and mass of the test specimen. They must be entered in conformity with the specified units and the results of respective measurements. The last item (9) determines the location of the sampled material within the pavement width, in relation to the right-hand edge (shoulder) of the pavement. This is not applicable to specimens which are not from a pavement. In such a case, enter **0.00** at item No. 9.

11.3. "DETERMINE TEST SPECS" SCREEN

Compressive load to be applied, Volts

Enter load value in engineering units (Volts), e.g. 2.5. The value entered must be positive and less than 10 and should be equal to the quotient:

$$\frac{\textit{desired test load value (N)}}{\textit{load range cartridge calibration factor (N/V)}}$$



CAUTION!

- Double check your value.
- Wrong value will cause danger to operator, damage to machine, instrumentation and specimen.

Limiting strain value, μstrains

This entry controls the amount of vertical deformation of a specimen. It sets the maximum allowable strain in the specimen to ensure that permanent deformation does not exceed the required limit. When the limit is reached, the load is released immediately. An entry of 2500 is considered to be reasonable in many cases. However, in general the value is derived from a combination of pre-test trials and past experience.

Load pulse duration in repeated loading, s

Enter the duration of load pulse to be applied during the dynamic part of the test. It is the time within which the load rises from zero to the specified value and drops back to zero, following a haversine path. The value can range from 0.002 s up to several seconds or more. Entry of 0.1 s is frequently used for this type of test.

Rest period in repeated loading, s

Enter duration of the pause between the end of one load pulse and the beginning of next load pulse to be applied during the dynamic part of testing. It can range from 0.002 s to whatever is needed. This entry is usually close to one second.

Test temperature, °C

Enter temperature of the specimen to be kept constant during the test.

Stroke calibration factor, mm/Volt

Enter appropriate value depending on the range of the MTS stroke cartridge in use. Consult the report entitled "SOFTWARE FOR AUTOMATED TESTING OF ASPHALT MIXES. Documentation and Guide" for value to be used.

Load calibration factor, N/V

Enter appropriate value depending on the range of the MTS load cartridge in use. Consult the report entitled "SOFTWARE FOR AUTOMATED TESTING OF ASPHALT MIXES. Documentation and Guide" for value to be used.

Strain calibration factor, mm/Volt

Enter a valid calibration factor determined for the type of LVDTs or other instruments used in the test.

Spacing between LVDT clamps, mm

Enter the effective specimen length (height) which is used by LVDTs or other type of sensors for the purpose of vertical strain measurement during the test.

Test humidity, %

Enter the value of relative air humidity at the time of the test.

12. USER'S CONTROL OVER THE TESTING PROCESS

Once all the required input data are entered, instrumentation checked, specimen properly in-place, the test is ready to start.

Select item ③ from the test menu. The screen as illustrated under p. 4.1 (SCREEN 1) should be on display.

Now, a final chance for checking the system is given before the start of a test by entering

GO + ↵

From now on, the test run is automatic until the end. This will only be interrupted when the system is destabilized (e.g. the servo-hydraulic loop becomes open) or the limiting strain value is exceeded. In the first case, the program will probably run in an endless loop until some sort of external intervention; also a system message may appear on the screen. In the second case, the load is zeroed, the program suspended and an alert of the problem is given by bell sound and a on-screen flashing message:

THE SPECIFIED LIMITING STRAIN VALUE HAS BEEN EXCEEDED

along with the following instruction:

RESTART TEST PROCEDURE USING A LOAD VALUE LOWERED BY 25%.

IF YOU WISH TO RESTART NOW, JUST TYPE 'GO', IF NOT - ENTER 'N':

The following two options are then given:

➤ restarting the test with a reduced compressive load value, or

➤ stopping the test and exiting the program.

If you select the first option, the test is started anew, i.e. with the first conditioning load application.

While the test is being executed, you are given several options for different situations:

◆ To stop the test at any time, or exit the test procedure prior to starting the test (i.e. before typing '**GO**'), touch:

ESC + S

The program will return to the test menu screen.

- To interrupt the resting period - while the program is waiting for strain values to reach the predetermined level (or for the specified time to elapse) - and to continue the test, touch:

ESC + B

The micro segment generator will resume at that point and normal testing procedure will continue.

- To display time elapsed since the beginning of the test, touch:

ESC + T

The time elapsed will be displayed for approximately three seconds.

- To return to the test menu screen right after completion of the test, i.e. when the 'TEST COMPLETED' message is on display, follow the on-screen instructions.

During the test you can use the MTS Data Display Unit, i.e. the oscilloscope, or/and the recorder/plotter to monitor the actual level of readings on any of the active channels.

NOTE

Although the whole process is automatic, the operator can interfere at some points of the test if needed. The controlling processor is very sensitive to external signals, and therefore any interference could easily cause distortion of the results or even destabilize the system. Such signals can even be caused by static electricity, e.g. by an accidental touching the test instrumentation. Thus, proper precautions are necessary to ensure uninterrupted testing and valid results.

13. PROGRAM OUTPUT

13.1. SCREEN OUTPUT DURING TESTING

On-screen guidance is given throughout the test. The following are the messages normally displayed.

SCREEN 1:

THIS IS A LOAD CONTROL TEST

PLEASE, CHECK IF CONTROL IS TRANSFERRED TO A PROPER CONTROLLER

BE SURE ALL OTHER SETTINGS ARE CORRECT

IF READY - ENTER 'GO':

SCREEN 2:

FIRST CONDITIONING LOAD APPLIED

SCREEN 3:

SECOND CONDITIONING LOAD APPLIED

SCREEN 4:

THIRD CONDITIONING LOAD APPLIED

SCREEN 5:

@@@@@@@@@@@@@@@@@@@@@@@@@@

548 s

... TO COMPLETION OF STATIC LOADING

SCREEN 6:

Resting...

86.52 = stroke(%).....(%)strain = 83.95

LOAD GENERATION WILL BE RESUMED AUTOMATICALLY AFTER 3600 s

[TO RESUME LOAD GENERATION IMMEDIATELY, PRESS ESC * B]

SCREEN 7:

CREEP TEST UNDER EXECUTION

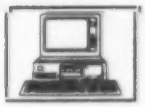
THE SPECIMEN IS LOADED OVER TIME PERIODS RANGING FROM 0.1 TO 1000 s
DEFORMATION IS MEASURED AS SPECIFIED

SCREEN 8:

8751

CREEP TEST IN PROGRESS ...

NOW EXECUTING CYCLIC HAVERSINE LOADING
NUMBER OF CYCLES COMPLETED IS BEING DISPLAYED ABOVE



SCREEN 9:

@@@@@@@@@@@@@@@@@@@@@@@@@

384 s

... TO COMPLETION OF TEST

SCREEN 10:

TEST COMPLETED ..... ***** ..... **TEST COMPLETED**

< ESC * K > TO CONTINUE

13.2. TESTING RESULTS

GRAPHICS

Selecting "PLOT GRAPHS" item from the test menu causes switching to a graphics mode and invoking graphics routine. All necessary scaling and labelling calculations are executed and the following four graphs are presented consecutively (press ↵ to display the next graphic on screen):

1. *CREEP COMPLIANCE vs TIME OF LOADING (STATIC)*
2. *PERMANENT DEFORMATION AS A FUNCTION OF TIME (INCREMENTAL LOADING)*
3. *VERTICAL DEFORMATION DURING THE 1000 S STATIC LOADING*
4. *DEFORMATION AS A FUNCTION OF HAVERSINE LOAD CYCLING*

After pressing ↵ the program exits from graphics to the test menu screen.

TABULATED DATA POINTS

After selecting "LIST ACQUIRED DATA" item from the test menu, two screens are presented with the following results:

SCREEN 1

"Permanent" deformation due to repetitive static loading.

Accumulated deformation during the 1000 s static loading.

SCREEN 2

Total "permanent" deformation due to haversine dynamic loading.

Deformation measured during haversine dynamic loading.

Strain amplitude at 200th cycle of haversine dynamic loading.

Total "permanent" deformation due to the entire test loading.

Next to these screens, you can choose to display the table of strain values acquired at loading over 0.1 s during the static part of the test and/or return to the test menu screen.

TEST REPORT

"TEST REPORT" screen is displayed upon selection of "PRINT TEST REPORT" item from the test menu. The format of a standard report is illustrated in Appendix C. It contains sample identification data, test specifications and the most essential test results, i.e. creep compliance values and the material parameters (ALPHA and MU). There is also room at the bottom of the screen for making short notes or comments related to the test.

Occasionally, instead of the screen, the following flashing message is displayed when one or both values of the parameters ALPHA, MU turns out to be zero or negative. This means that something has gone wrong during the test. The values should be

SORRY, NO VALID RESULTS FOR THE REPORT PERMANENT DEFORMATION PROPERTIES ARE OUT OF RANGE

positive and normally less than one.

14. USER'S INPUT AND PROGRAM OUTPUT

Creep compliance test results can differ significantly from test to test for a given mix, depending primarily on test temperature. The example given in the Appendix is for illustrative purposes only; it is specific for the material and temperature level at which the test was carried out.

DESCRIPTION OF VARIABLES USED IN THE PROGRAM

(A) NUMERIC VARIABLES (SCALARS)

NAME	DESCRIPTION
A	Variable used by privileged function call SYS for disabling the CTRL-C as the means of exiting a running program
A0	Assigned expression value (10 × stroke calibration factor), mm
A1 ÷ A5	Stroke amplitude after 0.1, 1, 10, 100, 1000 s loading, respectively, recorded with ADIMMED function, n.e.u. (normalized engineering unit); also, the same stroke but relative to the initial stroke amplitude (right after conditioning, prior to the start of the test) and expressed in mm
A7	Strain after conditioning, recorded with ADIMMED function prior to the static stage, n.e.u.
A8	Strain just before 1000 s static loading, recorded with ADIMMED function, n.e.u.
A9	Strain just before dynamic loading, recorded with ADIMMED function, n.e.u.; also, corresponding strain value in μstrains
B4, E1	Difference between stroke value just before the first conditioning load and stroke value prior to current static loading recorded with ADIMMED function, n.e.u.; also, remaining stroke (not yet recovered) prior to the static loading, % of the original value (before conditioning)
B5, E2	Difference between strain value just before the first conditioning load and strain prior to current static loading recorded with ADIMMED function, n.e.u.; also, remaining strain (not yet recovered) prior to the static loading, % of the original value (before conditioning)
B6	the triggering value of strain, % of original strain (before conditioning) which must be reached before the static incremental loading is started
B8	Strain amplitude, recorded with ADIMMED function at different points of static loading to check if the limiting strain value has not been exceeded; if so, the test would be stopped
B9	Flag indicating that the 201th cycle of dynamic haversine loading is over and ADRMAX, ADRMIN functions are disabled
C	Assigned channel number used for recording the vertical strain of the specimen
C0	Flag indicating which consecutive preconditioning loading is executing currently or is about to be executed
C2	Test restart counter (when the limiting strain value was exceeded)

C3	Counter of loading cycles completed by FGARB call
C4	Counter of buffered calls completed
C6	Current clock setting (CKTIME function), seconds/interrupt
C7	Counter of loading cycles completed (assigned expression value)
C8	Number of dynamic loading cycles set to be completed in the test
D	Counter of the remaining buffered calls to be completed
D0	Assigned expression value; strain recorded prior to the static incremental loading, μstrains
D2	Strain amplitude (max-min) at 200th cycle of haversine loading, μstrains
D3	Stroke recorded right after completing the haversine dynamic loading; also, difference between stroke after the dynamic loading and stroke right before the dynamic loading (= 'permanent' deformation due to the dynamic loading), mm
D4	Strain recorded right after completing the haversine dynamic loading; also, difference between strain recorded after the dynamic loading and strain right before the dynamic loading (= 'permanent' strain due to the dynamic loading), μstrains
D5	Difference between stroke recorded right after completing the haversine dynamic loading and stroke just before the start of static repetitive loading series (= total 'permanent' deformation due to the test), mm
D6	Difference between strain recorded right after completing the haversine dynamic loading and strain just before the start of static repetitive loading series (= total 'permanent' strain due to the test), μstrains
D9,M9,Y0	Day, month, year returned by GDATE function
E1, E2	See B4, B5
E6,E7,E8	Seconds, minutes, hours in time displayed; calculated from GTIME current values and those recorded at the beginning of the test
E9	The number of seconds elapsed since the beginning of the test
F	Flag marking the end of a specified specimen relaxation period after completion of static loading
F0	Stroke measured after conditioning, prior to the static loadings, recorded with ADIMMED function, n.e.u.
F1	Stroke measured just before dynamic loading, recorded with ADIMMED function, n.e.u.; also, corresponding stroke value in mm

F7	Absolute value of D2, μstrains
F8	The value of ALPHA parameter according to formula: G8×G7/F7 (static loading)
F9	The value of MU parameter according to formula: 1–G7 (static loading)
G	The length of T8 string
G0	Flag marking the start of resting period after conditioning and the first readings of F0, A7 values
G1	The length of string K6
G2 ÷ G7	Intermediate expression values used in calculation of G8
G8	Assigned expression value used in calculation of ALPHA parameter obtained due to static loading
H	The rest period between consecutive load pulses in dynamic loading, s
H7	Strain value after one load pulse, recorded with ADIMMED function, n.e.u.
H8	Strain value after 10009 load pulses, recorded with ADIMMED function, n.e.u.
H8,M8,S8	Hour, minute, second, returned at the start of the test (i.e. at applying the first conditioning load) by GTIME function
H9,M9,S9	Hour, minute, second, returned during the test duration by GTIME function
I1	Number of data entry items in the first data entry screen
I2	Number of data entry items in the second data entry screen
I4	Counter; also, stroke value just before the 1000 s static loading, mm
J1	Flag marking the 1st or the 2nd data entry screen as a current one
1 ÷ K9	Assigned expression values used for coding the day of the week
K6	Time remaining (in seconds) to the end of 10-min period or flag marking the end of 10-min period of reduction the conditioning load to zero; also, see K1 ÷ K9
K7	Time elapsed (in seconds) since the start of 10-min period; also, see K1 ÷ K9
K8	Time remaining (in seconds) to the end of 15-min waiting period marking the end of test; also, see K1 ÷ K9
K9	Time elapsed (in seconds) since the start of 15-min waiting period; also, see K1 ÷ K9

L0	Compressive load specified in the test and used by the load generating functions (for preconditioning), n.e.u.
L1	Compressive load specified in the static and dynamic parts of the test, n.e.u.
L2	Assigned expression value (load*4) in stress calculation, N or N/mm^2
L3	Assigned expression value (4*specimen cross-sectional area), mm^2
L8	The value of ALPHA parameter according to formula: P8×P7/F7 (dynamic loading)
L9	The value of MU parameter according to formula: 1–P7 (dynamic loading)
M0	Flag marking application of the second conditioning load
M1	Strain calibration factor, mm/V
M8, M9	See H8, H9
N1 ÷ N4	"Permanent" strain after 0.1, 1, 10, 100 s, respectively, of static incremental loading, μstrains
N5	The number of test menu items
N6	"Permanent" strain after 1000 s of static incremental loading, μstrains
O1	Flag marking the start of 10 s static incremental loading
P1 ÷ P7	Assigned expression values used in calculation of P8
P8	Assigned expression value used in calculation of ALPHA parameter obtained due to dynamic loading
Q1 ÷ Q4	Used for temporary storage of strain values recorded after 0.1, 1, 10, and 100 s of static incremental loading
R1, R2	Array scalars in R1(,) and R2(,) arrays, respectively
R3	Flag marking the fact that the 200th cycle in dynamic loading has been reached
S	Counter of an array S(,)
S0	Current number of buffered (not completed yet) calls to the function generator
S1	Array scalar in S1(,) array
S3	Strain value (average of 5 last points in array S2(,)) recorded during the 0.1 s incremental static loading
S4	Stroke value recorded just before the 1st conditioning load

S5	Strain value recorded just before the 1st conditioning load
S8, S9	See H8, H9
T0	Half-time of load pulse duration in dynamic haversine loading, s
T1	Load pulse duration in dynamic haversine loading, s
T2, T3	Start position of displayed strings T2$ and T3$, respectively
T4	Consecutive number of the creep test results about to be saved
T5	Time elapsed since the end of conditioning loading (prior to the first static incremental loading), s
T8	Time remaining to the end of a specified specimen relaxation period after the 1000 s incremental static loading, s
T9	Time elapsed during the 1000 s incremental static loading, s
U1 ÷ U4	Used for temporary storage of stroke values recorded after 0.1, 1, 10, and 100 s of static incremental loading
X0	Flag marking the end of saving the results of test to a disk file
X1	Flag indicating that MU parameter (static loading) is valid and that the test results are about to be saved if saved not yet
X8	Error code indicating status of file opened for output of test results
X9	Time elapsed during the specified specimen relaxation period following the 1000 s incremental static loading, s
Y0	See D9
Y4, Y5	Assigned expression values used in calculation of Y6
Y6	Increment of y-axis labelling ticks for plotting the strain over the 1000 s incremental static loading, μstrains
Z	Assigned expression value representing difference between strain at the start of the test and a current strain value, μstrains
Z1	Assigned expression value derived from LVDT's clamps spacing, 1/mm
Z2	The limiting strain value specified for the test (if exceeded then the test is usually stopped and no valid results are obtained), μstrains
Z3	Assigned expression value derived from the LVDT's spacing (used in calculation of strain due to static incremental loading), 1/V
Z5	Time elapsed during the ½ hour waiting period before an automatic switching-off the system hydraulics

Z6	Compressive load applied in the test, N
Z8	Intermediate variable used in sorting of B30 array values
Z9	Flag used in sorting of the B30 array values

(B) ARRAYS

NAME	DESCRIPTION
B1(10)	Stroke readings acquired with ADIMMED function during the 1000 s static loading, n.e.u.; also, differences between a current value and initial value I4 (prior to the 1000 s loading) of stroke, mm
B2(10)	Strain readings acquired with ADIMMED function during the 1000 s static loading, n.e.u.; also, differences between a current value and initial value A8 (prior to the 1000 s loading) of strain, μstrains
B3(5)	Strain values recorded after consecutive incremental loadings during the static part of the test, μstrains
B7(6)	See B30 array
D1(6)	Stroke values recorded during dynamic haversine loading, n.e.u.; also, differences between a current value and the initial value F1 (prior to dynamic loading) of stroke, mm
D7(10)	Stress values calculated using B20 array strains and L2 stresses, N/mm^2; also, calculated creep compliance values during the 1000 s static loading
F3(6)	Calculated relative strain values measured during dynamic loading, μstrains
F4(6)	Calculated relative stroke values measured during dynamic loading, mm
F5(5)	Calculated relative strain values measured during repetitive static loading, μstrains
F6(5)	Calculated relative stroke values measured during repetitive static loading, mm
H1(6)	Strain values recorded during the dynamic part of the test, n.e.u.; also, differences between a current value and the initial value A9 (prior to the dynamic loading) of strain, μstrains
H3(10)	Consecutive numbers of test results saved according to the MTS test type

R1(1,1) Stores the minimum amplitude level recorded on a specified channel during the 200th loading cycle in dynamic loading; used in ADRMIN function. Format of the array:

Number of Interrupts Since Last Change	Channel Nº: C (Strain)
R1(1,0)	R1(1,1)

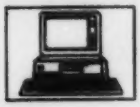
R2(1,1) Stores the maximum amplitude level recorded on a specified channel during the 200th loading cycle in dynamic loading; used in ADRMAX function. Format of the array:

Number of Interrupts Since Last Change	Channel Nº: C (Strain)
R2(1,0)	R2(1,1)

S(20,2) Minimum and maximum values (valleys and peaks) recorded during static incremental loading, n.e.u.

S1(300,1) Stores an array of strain values, in binary format, acquired at the 0.1 s incremental static loading ; used in ADBURST function. Format of the array:

Row Nº	Number of Interrupts Between Readings	Channel Nº C (STRAIN)
0	[redacted]	S1(1,0)
1	S1(1,0)	S1(1,1)
2	S1(2,0)	S1(2,1)
3	S1(3,0)	S1(3,1)
...	.....	.....
300	S1(300,0)	S1(300,1)



S2(300) Strain values from the array S1(,) after convertion to engineering units, V

W(3,1) Stores the segments of dynamic loading waveform; used by the micro segment generator. Format of the array:

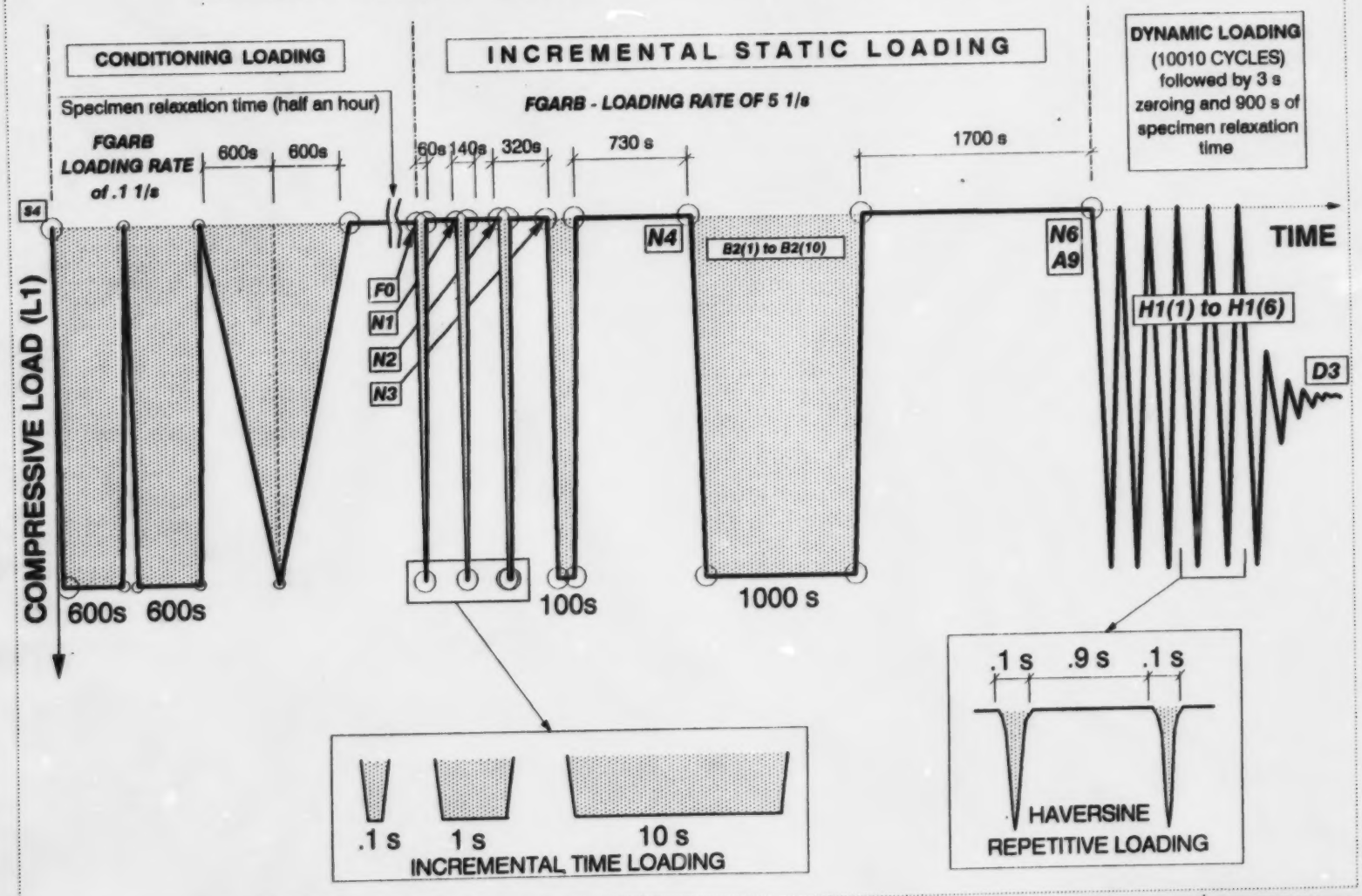
ROW Nº	COLUMN Nº	
	0	1
1	W(1,0) = **T0**	W(1,1) = **-ABS(L1)**
2	W(2,0) = **T0**	W(2,1) = **0**
3	W(3,0) = **H**	W(3,1) = **0**

(C) STRINGS AND STRING ARRAYS

NAME	DESCRIPTION
C$(N5)	Consecutive numbers of the Test Menu items
D$	Date string, as returned by DAT$ function
E9$	Time elapsed since the beginning of a test; displayed when invoked by the user
F2$	Name of the file under which the test results are saved on a hard disk; also, assigned string constant
H2$(10)	Short names of laboratory tests performed using the MTS electro-hydraulic system
J$(10)	User's entries for the test specimen identification and description
J1$(10)	As J$(10) but after correction if any was done
K2$	Day of the week in the date of the test
K3$(7)	Assigned substrings of the weekdays' names
L$(12)	User's entries for test specifications
M$(70)	Test data (results) to be saved to a disk file

M4$	User's entry under the Test Report "NOTES" prompt
O$(N5)	Test Menu items
P$	Assigned string constant
T1$ ÷ T3$	Assigned string constants
V1$ ÷ V3$	Day, month, year, in the test date representation

CREEP COMPLIANCE TEST LOADING PATTERN



THE PROGRAM CODE LISTING

```
10 REM  --- CREEP COMPLIANCE TEST --- Oct. 1987 ** By R. Raciborski
20 REM  --- CREEP.BAS ---------- Last update: August 26, 1991
30 CRT80COL \ A=SYS(8) \ CNFWRN(B) \ IF B=1 THEN 50
40 GO TO 80
50 CLRTXWIN \ TXTSPOS(,12,14) \ TXTFLASH
60 PRINT "ERROR! CURRENT HARDWARE CONFIGURATION DOES NOT MATCH"
70 TXTSPOS(,13,29) \ PRINT "CONFIGURATION FILES" \ TXTNORMAL \ ETIME \ SLEEP(10) \
    CLRTXWIN \ GO TO 4550
80 DIM K3$(7),I$(10),J$(10),J1$(10),K$(12),L$(12) \ LCVAR \ C=5 \ C8=10010 \C2=0 \ B6=80
90 I$(1)="PAVEMENT SAMPLE ID.(A999999X99):" \ I$(2)="SPECIMEN ID.(AAX99XA999):"
100 I$(3)="DATE OF SAMPLE (MMDDYY):" \ I$(4)="MIX DESIGN ID.(AA9999):"
110 I$(5)="TEST ID.(AA9999):" \ I$(6)="SPECIMEN HEIGHT (mm):"
120 I$(7)="SPECIMEN DIAMETER (mm):" \ I$(8)="SPECIMEN MASS (kg):"
130 I$(9)="DISTANCE FROM PAVEM. EDGE (m):"
140 K$(1)='COMPRESSIVE LOAD TO BE APPLIED (volts):
150 K$(2)='LIMITING STRAIN VALUE (microstrains):
160 K$(3)='LOAD PULSE DURATION IN REPEATED LOADING (s):
170 K$(4)='REST PERIOD IN REPEATED LOADING (s):
180 K$(5)='TEST TEMPERATURE (C):
190 K$(6)='STROKE CALIBRATION FACTOR (mm/Volt):
200 K$(7)='LOAD CALIBRATION FACTOR (Newton/Volt):
210 K$(8)='STRAIN CALIBRATION FACTOR (mm/Volt):
220 K$(9)='SPACING BETWEEN LVDT CLAMPS (mm):
230 K$(10)='TEST HUMIDITY (%):
240 M4$="" \ T2$="**** CREEP COMPLIANCE TEST ****" \ T3$="M E N U"
250 T2=INT((80-LEN(T2$))/2) \ T3=INT((80-LEN(T3$)))/2 \ P$="SELECT ITEM # FOR CHANGE"
260 E0$="SELECT ITEM NUMBER TO CORRECT" \ T1$="CORRECT ENTRY IS = "
270 DATA 8,"<1>","IDENTIFY SAMPLE","<2>","DETERMINE TEST SPECS"
280 DATA "<3>","RUN THE TEST","<4>","PLOT GRAPHS","<5>","LIST ACQUIRED DATA"
290 DATA "<6>","PRINT TEST REPORT","<7>","SAVE TEST RESULTS"
300 DATA "<8>","QUIT THE PROGRAM" \ I1=9 \ I2=10
310 K3$(1)="SUN" \ K3$(2)="MON" \ K3$(3)="TUES" \ K3$(4)="WEDNES"
320 K3$(6)="FRI" \ K3$(7)="SATUR" \ K3$(5)="THURS"
330 GO TO 1870
340 REM Graphics
350 G1$='T i m e  (seconds)' \ G2$='Number of Load Cycles'
360 G3$='STRAIN * mcstrains' \ G4$='Creep Compliance I I sqm/MN' \ TEKMODE \ GO TO 400
370 GO TO 480
380 Y4=INT(LOG10((1.1*B2(10))/5)) \ Y5=10^Y4 \ Y6=(1.1*B2(10))/(5*Y5) \ Y6=INT(Y6) \ Y6=Y6*Y5
      \ GO TO 570
390 GO TO 660
400 PHYL(1,0,100,15,100) \ SCALE(1,2,1.00000E-03,1000,.75*D7(1),1.05*D7(10))
410 HOME \ PRINT CHR$(27)+'a'; \ LABEL(,"","",5,500,2) \ HOME \ PRINT CHR$(27)+'h';
420 AXES(1,1.00000E-03,.75*D7(1)) \ AXES(1,1000,1.05*D7(10)) \  LABEL(1,G1$,G4$,5,500,1)
430 FOR I=1 TO 9 \ MARK(1,5,(3^(I-1))/30,D7(I)) \ NEXT I
440 MARK(1,5,1000,D7(10))
450 COMM(1,'CREEP COMPLIANCE vs TIME OF LOADING (STATIC)',.01,1.01*D7(10))
460 INPUT #0:R$ \ IF R$="" THEN CLGRWIN \ TEKMODE \ GO TO 370
```

```
470 GO TO 460
480 PHYL(1,0,100,15,100) \ GOSUB 2030
490 SCALE(1,3,.1,1000,.75*B3(1),1.05*B3(5)) \ HOME \ PRINT CHR$(27)+'a';
500 LABEL(,"","",5,1,2) \ HOME \ PRINT CHR$(27)+'h'; \ AXES(1,.1,.75*B3(1)) \
      AXES(1,1000,1.05*B3(5))
510 LABEL(1,G1$,G3$,5,2,1) \ INVEC(1)
520 FOR I=1 TO 5 \ PLOT(1,10^(I-2),F5(I)) \ MARK(1,5,10^(I-2),F5(I)) \ NEXT I
540 COMM(1,'PERMANENT DEFORMATION AS A FUNCTION OF TIME (Increm. Loading)',
      .11,.85*F5(5))
550 INPUT #0:R$ \ IF R$="" THEN CLGRWIN \ TEKMODE \ GO TO 380
560 GO TO 550
570 PHYL(1,0,100,15,100) \ SCALE(1,2,1.00000E-03,1000,0,1.05*B2(10))
580 HOME \ PRINT CHR$(27)+'a'; \ LABEL(,"","",5,Y6,2) \ HOME
590 PRINT CHR$(27)+'h'; \ AXES(1,1.00000E-03,0) \ AXES(1,1000,1.05*B2(10))
600 LABEL(1,G1$,G3$,5,Y6,1)
610 FOR I=1 TO 9 \ MARK(1,3,(3^(I-1))/30,B2(I)) \ NEXT I
620 MARK(1,3,1000,B2(10))
630 COMM(1,'VERTICAL DEFORMATION DURING 1000s STATIC LOADING',6.00000E-03,
      .95*B2(10))
640 INPUT #0:R$ \ IF R$="" THEN CLGRWIN \ TEKMODE \ GO TO 660
650 GO TO 640
660 H7=F3(1) \ H8=F3(6)
670 FOR I=1 TO 5 \ IF H7>F3(I+1) THEN H7=F3(I+1)
680 IF H8<F3(I) THEN H8=F3(I)
690 NEXT I
700 PHYL(1,0,100,15,100)
710 SCALE(1,3,1,100000,.75*H7,1.05*H8) \ HOME \ PRINT CHR$(27)+'a'; \ LABEL(,"","",2.5,2,2)\
      HOME
720 PRINT CHR$(27)+'h'; \ AXES(1,1,.75*F3(1)) \ AXES(1,100000,1.05*F3(6)) \
      LABEL(1,G2$,G3$,2.5,1,1)
730 FOR I=1 TO 5 \ MARK(1,3,10^(I-1),F3(I)) \ NEXT I
740 MARK(1,3,C8,F3(6)) \ INVEC(1)
750 FOR I=1 TO 5 \ PLOT(1,10^(I-1),F3(I)) \ NEXT I
760 PLOT(1,C8,F3(6))
770 COMM(1,'DEFORMATION AS A FNCTN OF HAVERSINE LOAD CYCLING',
      3,.85*H8)
780 INPUT #0:R$ \ IF R$="" THEN VTMODE \ GO TO 1870
790 GO TO 780
800 CLRTXWIN \ TXTBOLD
810 PRINT TAB(12)"^PERMANENT^ DEFORMATION DUE TO REPETITIVE STATIC LOADING" \
      TXTNORMAL
820 A6$='LOAD TIME (s)' \ A7$='STROKE (mm)' \ A8$='STRAIN (mcstrains)'
830 PRINT \ PRINT TAB(16)A6$TAB(31)A7$TAB(46)A8$
840 PRINT TAB(19)'.1'TAB(30)(F0-A1)*A0TAB(50)F5(1) \ PRINT TAB(19)'1.0'TAB(30)(F0-A2)*A0
      TAB(50)F5(2)
850 PRINT TAB(19)'10'TAB(30)(F0-A3)*A0TAB(50)F5(3) \ PRINT TAB(19)'100'TAB(30)(F0-A4)*A0
      TAB(50)F5(4)
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860 PRINT TAB(19)'1000'TAB(30)(F0-A5)*A0TAB(50)F5(5) \ PRINT  \ TXTBOLD
870 PRINT TAB(15)"ACCUMULATED DEFORMATION DURING 1000s STATIC LOADING"
880 TXTNORMAL \ PRINT  \ PRINT TAB(16)A6$TAB(31)A7$TAB(46)A8$
890 FOR I=1 TO 9 \ PRINT TAB(19)INT(((3^(I-1))/30)*1000+.5)/1000TAB(30)B1(I)
      TAB(50)B2(I) \ NEXT I
900 PRINT TAB(19)'1000'TAB(30)B1(10)TAB(50)B2(10)
910 TXTSPOS(,24,30) \ PRINT '<CR> FOR MORE DATA'; \ INPUT #0:R$
920 IF R$="" THEN 940
930 GO TO 910
940 CLRTXWIN \ TXTBOLD \ PRINT TAB(9)'TOTAL ^PERMANENT^ DEFORMATION DUE TO DYNAMIC
      HAVERSINE LOADING:' \ TXTNORMAL
950 PRINT  \ PRINT TAB(30)"Stroke =";D3'mm' \ PRINT TAB(30)"Strain=";D4;'mcstrains'
960 PRINT  \ TXTBOLD \ PRINT TAB(18)'DEFORMATION MEASURED DURING HAVERSINE LOADING'
      \ TXTNORMAL
970 A9$='NO.OF CYCLES' \ PRINT  \ PRINT TAB(16)A9$TAB(31)A7$TAB(46)A8$
980 FOR I=1 TO 5 \ PRINT TAB(25-I)10^(I-1)TAB(30)F4(I)TAB(50)F3(I) \ NEXT I
990 REM PRINT TAB(20)C8TAB(30)D1(6)TAB(50)H1(6)
1000 PRINT  \ PRINT TAB(8)'STRAIN AMPLITUDE AT 200th CYCLE OF HAVERSINE LOADING:
       ';D2;'mcstrains'
1010 PRINT  \ PRINT TAB(13)'Total Permanent Deformation Due to the Test: '
1020 PRINT  \ PRINT TAB(30)"Stroke =";D5;'mm' \ PRINT TAB(30)"Strain=";D6;'mcstrains'
1030 TXTSPOS(,22,10) \ PRINT "DO YOU NEED STRAIN VALUES ACQUIRED DURING LOADING OVER
       .1s?(Y/N) "; \ INPUT #0:R$
1040 IF R$='N' THEN 1870
1050 IF R$<>'Y' THEN 1030
1060 CLRTXWIN \ TXTSPOS(,2,11) \ TXTBOLD \ PRINT "STRAIN VALUES MEASURED DURING
       LOADING OVER .1s (microstrains)"
1070 TXTNORMAL \ PRINT
1080 FOR I=1 TO 50
1090 FOR J=10 TO 60 STEP 10 \ PRINT TAB(J)S2(J/10+(I-1)*6); \ NEXT J
1100 PRINT  \ NEXT I
1110 TXTSPOS(,23,34) \ PRINT "<CR> TO EXIT"; \ INPUT #0:R$ \ IF R$="" THEN 1870
1120 IF R$<>"" THEN 1110
1130 IF X1<>.88 THEN 1160
1150 GO TO 1190
1160 CLRTXWIN \ TXTSPOS(,10,22) \ TXTFLASH \ PRINT "SORRY, NO VALID RESULTS FOR THE
       REPORT" \ TXTNORMAL
1170 TXTSPOS(,12,15) \ PRINT "PERMANENT DEFORMATION PROPERTIES ARE OUT OF RANGE."
1180 INPUT #0:R$ \ GO TO 1870
1190 CLRTXWIN \ TXTSPOS(,1,35) \ TXTBOLD \ PRINT "TEST REPORT" \ TXTNORMAL
1200 TXTSPOS(,2,6) \ PRINT "-----------------------"
1210 TXTSPOS(,3,6) \ PRINT "** CREEP COMPLIANCE TEST **"
1220 TXTSPOS(,3,50) \ PRINT "DATE OF TEST: "DAT$(D$)
1230 GDATE(D9,M9,Y0) \ V1$=STR$(D9) \ V2$=STR$(M9) \ V3$=STR$(Y0)
1240 TXTSPOS(,4,6) \ PRINT "-----------------------" \ GOSUB 1520
1250 TXTSPOS(,4,50) \ PRINT K2$;" " "E9":"E8":"E7 \ TXTSPOS(,5,50) \ PRINT "TEST ID.:      ";JS(5)
1260 TXTSPOS(,7,6) \ TXTUNLINE \ PRINT "SAMPLE IDENTIFICATION" \ TXTNORMAL
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1270 TXTSPOS(,8,6) \ PRINT "1.PAVEMENT SAMPLE ID.:"TAB(23)J$(1)TAB(37)"4.DATE OF SAMPLE:"
     TAB(60)J$(3)
1280 TXTSPOS(,9,6) \ PRINT "2.SPECIMEN ID.:"TAB(23)J$(2)TAB(37)"5.MIX DESIGN ID.:"TAB(60)J$(4)
1290 TXTSPOS(,10,6) \ PRINT "3.SPEC. HEIGHT (mm):"TAB(23)J$(6)TAB(37)"6.SPECIMEN DIA.(mm):"
     TAB(60)J$(7)
1300 PRINT  \ TXTSPOS(,12,6) \ TXTUNLINE \ PRINT "TEST PARAMETERS" \ TXTNORMAL
1310 Z6=INT(VAL(L$(1))*VAL(L$(7))+.5)
1320 TXTSPOS(,13,9) \ PRINT "1.COMPRESSIVE LOAD (N):"TAB(26)Z6TAB(35)"4.TEST TEMPERATURE
     (C):"TAB(58)L$(5)
1330 TXTSPOS(,14,9) \ PRINT "2.LOAD PULSE DURATION (s):"TAB(27)L$(3)TAB(35)"5.CLAMPS
     SPACING (mm):"TAB(58)L$(9)
1340 TXTSPOS(,15,9) \ PRINT "3.REST BETWEEN PULSES (s):"TAB(27)L$(4)
1350 PRINT  \ TXTSPOS(,17,6) \ TXTUNLINE \ PRINT "TEST RESULTS" \ TXTNORMAL
1360 PRINT  \ PRINT TAB(8)"TSTATIC: "; \ TXTBOLD \ PRINT ".033,.1,.3,.9,2.7,8.1,24.3,72.9,
     218.7,1000" \ TXTNORMAL
1370 PRINT TAB(8)"CREEP COMPL.(m^2/MN), for each TSTATIC listed above: "
1380 TXTBOLD \ FOR I=1 TO 10
1390 IF I>5 THEN 1410
1400 TXTSPOS(,21,18+(I-1)*12) \ PRINT USING "-#.###^^^^^",D7(I)
1410 IF I>5 THEN TXTSPOS(,22,18+(I-6)*12) \ PRINT USING "-#.###^^^^^",D7(I)
1420 NEXT I
1425 TXTNORMAL \ U$="ALPHA: stat =          dyn =                    GNU:  stat =          dyn ="
1430 V$="-#.###" \ TXTSPOS(,23,9) \ PRINT U$
1435 TXTSPOS(,23,22) \ TXTBOLD \ PRINT USING V$,L8
1440 TXTSPOS(,23,34) \ PRINT USING V$,F8 \ TXTSPOS(,23,55) \ PRINT USING V$,L9
1445 TXTSPOS(,23,67) \ PRINT USING V$,F9 \ TXTNORMAL
1450 PRINT TAB(6)"NOTES (<128 characters): ";
1460 INPUT #0:R$ \ IF R$="" THEN GO TO 1500
1470 M4$=M4$+R$ \ IF LEN(M4$)>=127 THEN GO TO 1490
1480 GO TO 1460
1490 PRINT TAB(22)"<CR> TO GET MENU, ANY OTHER - TO QUIT "; \ INPUT #0:R$
1500 IF R$<>"" THEN 1990
1510 GO TO 1870
1520 D9=1900+VAL(V1$) \ M9=VAL(V2$) \ Y0=VAL(V3$)
1530 K1=INT(.6+(1/M9)) \ K2=D9-K1 \ K3=M9+12*K1 \ K4=K2/100 \ K5=INT(K4/4)
1540 K6=INT(K4) \ K7=INT((5*K2)/4) \ K8=INT(13*(K3+1)/5)
1550 K9=K5-K6+K7+K8+Y0-1 \ K9=K9-(7*INT(K9/7))+1 \ K2$=K3$(K9)&"DAY" \ RETURN
1560 CLRTXWIN
1562 PRINT TAB(17)CHR$(27)&"#3";"CREEP  COMPLIANCE  TEST"
1562 PRINT TAB(17)CHR$(27)&"#4";"CREEP  COMPLIANCE  TEST"
1566 TXTSPOS(,4,60) \ PRINT "Date:  "DAT$(D$) \ TXTSPOS(,5,60) \ GTIME(S9,M9,H9) \ PRINT
     "Time:  ";H9;":";M9
1568 PRINT \ TXTUNLINE \ PRINT "COMMENT: " \ TXTNORMAL
1570 PRINT "* "; \ INPUT #0:C0$
1571 IF C0$="" THEN PRINT "———————— end of user notes ————————"; \ GO
     TO 1574
1572 GO TO 1570
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1574 INPUT #0:C0$
1576 CLRTXWIN \ TXTSPOS(,3,30) \ TXTUNLINE \ PRINT "SAMPLE IDENTIFICATION" \ TXTNORMAL
1578 FOR I=1 TO I1
1580 TXTSPOS(,4+I,21) \ PRINT "(";STR$(I);")"TAB(5)I$(I)TAB(40); \ INPUT #0:J$(I)
1590 IF J$(I)=CHR$(63) THEN 1870
1600 NEXT I
1610 J1=99 \ GO TO 1690
1620 VTMODE \ CLRTXWIN \ TXTSPOS(,2,31) \ TXTUNLINE
1630 PRINT "TEST SPECIFICATIONS" \ TXTNORMAL
1640 FOR I=1 TO I2
1650 TXTSPOS(,3+I,14) \ PRINT "(";STR$(I);")"TAB(5)K$(I); \ INPUT #0:L$(I)
1660 IF L$(I)="?" THEN 1870
1670 NEXT I
1680 J1=100
1690 TXTSPOS(,18,31) \ TXTINVERS \ PRINT "ANY CHANGES?(Y/N): "; \ TXTNORMAL \ INPUT #0:R$
1700 IF R$<>"Y" THEN IF R$<>"N" THEN 1690
1710 IF R$="N" THEN 1810
1720 TXTSPOS(,20,26) \ PRINT P$+": "; \ INPUT #0:I
1730 IF I<1 GO TO 1800
1740 IF I>I2 GO TO 1800
1750 TXTSPOS(,22,28) \ TXTINVERS \ IF J1=100 THEN 1830
1760 PRINT T1$; \ TXTNORMAL \ INPUT #0:J1$(I) \ IF LEN(J1$(I))>=1 THEN J$(I)=J1$(I)
1770 CLRTXWIN \ TXTSPOS(,3,30) \ TXTUNLINE \ PRINT "SAMPLE IDENTIFICATION" \ TXTNORMAL
1780 FOR I=1 TO I1 \ TXTSPOS(,4+I,21) \ PRINT "(";STR$(I);")"TAB(5)I$(I)TAB(40)J$(I) \ NEXT I
1790 GO TO 1690
1800 TXTSPOS(,21,24) \ TXTINVERS \ PRINT E0$ \ TXTNORMAL \ GO TO 1720
1810 TXTSPOS(,23,23) \ PRINT "HIT <RETURN> TO PROCEED WITH TEST"; \ INPUT #0:B1$ \ IF B1$<>""
        GO TO 1810
1820 CLRTXWIN \ GO TO 1870
1830 TXTSPOS(,22,28) \ TXTINVERS \ PRINT T1$; \ TXTNORMAL \ INPUT #0:L$(I)
1840 CLRTXWIN \ TXTSPOS(,2,31) \ TXTUNLINE \ PRINT "TEST SPECIFICATIONS" \ TXTNORMAL
1850 FOR I=1 TO I2 \ TXTSPOS(,3+I,14) \ PRINT "(";STR$(I);")"TAB(5)K$(I)L$(I) \ NEXT I
1860 GO TO 1690
1870 RESTORE  \ READ N5 \ SETDIM C$(N5),O$(N5)
1880 FOR I=1 TO N5 \ READ C$(I),O$(I) \ NEXT I
1890 CLRTXWIN \ PRINT CHR$(27)+"P1p"\PRINT "S(I0,E,C0)W(I3,N0,P1,M1,F3,V,S0)"
1900 PRINT "P(0,0)(B)(0,40)V(+799)(,-40)(-60)(,+479)(+60)(,-40)(-799)(,+40)(+60) (,-479)(-60)
        (,+40)P(E);"
1910 PRINT "P(5,5)(B)(5,45)V(+789)(,-40)(-60)(,+469)(+60)(,-40)(-789)(,+40)(+60)(,-469)(-60)
        (,+40)P(E);"
1920 PRINT CHR$(27)+'\';
1930 TXTSPOS(,4,T2) \ TXTINVERS \ TXTBOLD \ PRINT T2$ \ TXTNORMAL
1940 TXTSPOS(,7,T3) \ TXTUNLINE \ PRINT T3$ \ TXTNORMAL
1950 FOR I=1 TO N5 \ TXTSPOS(,8+I,28) \ PRINT C$(I);" ";O$(I) \ NEXT I
1960 TXTSPOS(,19,29) \ PRINT "Your Choice (Enter #): "; \ INPUT #0:B
1970 ON B GO TO 1560,1620,3020,340,800,1130,4125,1990
1980 TXTSPOS(,22,25) \ PRINT "THAT'S NOT AVAILABLE, TRY AGAIN" \ GO TO 1960
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1990 CLRTXWIN \ PRINT  \ PRINT TAB(30)"ARE YOU SURE?(Y/N) "; \ INPUT #0:R$
2000 IF R$="N" THEN 1870
2010 IF R$<>"Y" THEN 1870
2020 CLRTXWIN \ KBREMOVE \ GO TO 4550
2030 FOR I=1 TO 5 \ B3(I)=F5(I) \ NEXT I
2040 FOR I=1 TO 4 \ Z9=0
2050 FOR J=1 TO 4 \ IF B3(J+1)>=B3(J) THEN 2070
2060 Z8=B3(J) \ B3(J)=B3(J+1) \ B3(J+1)=Z8 \ Z9=1
2070 NEXT J
2080 IF Z9=0 THEN 2100
2090 NEXT I
2092 IF B3(1)>0 THEN 2100
2094 IF B3(1)=0 THEN B3(1)=1
2096 FOR I=1 TO 5 \ IF F5(I)=0 THEN F5(I)=1
2098 NEXT I
2100 RETURN
2110 CLRTXWIN \ PRINT CHR$(27)+"P1p" \PRINT "S(I0,E,C0)W(I2,N0,P1,M1,F3,V,S0)"
2120 IF C0=1 THEN 2150
2130 IF C0=98 THEN 2160
2140 PRINT "P(100,150)T(S2,H6)'FIRST CONDITIONING LOAD APPLIED'" \ GO TO 2170
2150 PRINT "P(90,150)T(S2,H6)'SECOND CONDITIONING LOAD APPLIED'" \ M0=99 \ GO TO 2170
2160 PRINT "P(100,150)T(S2,H6)'THIRD CONDITIONING LOAD APPLIED'"
2170 PRINT CHR$(27)+'\' \ RETURN
2180 TXTSPOS(,10,27) \ TXTINVERS \ PRINT "CREEP TEST UNDER EXECUTION" \ TXTNORMAL
2190 TXTSPOS(,12,8) \ PRINT "THE SPECIMEN IS LOADED OVER TIME PERIODS RANGING FROM .1
        TO 1000 s"
2200 TXTSPOS(,13,23) \ PRINT "DEFORMATION IS MEASURED AS SPECIFIED" \ RETURN
2210 TXTSPOS(,10,29) \ TXTINVERS \ PRINT "CREEP TEST IN PROGRESS..." \ TXTNORMAL
2220 TXTSPOS(,12,22) \ PRINT "NOW EXECUTING CYCLIC HAVERSINE LOADING"
2230 TXTSPOS(,13,17) \ PRINT "NUMBER OF CYCLES COMPLETED IS BEING DISPLAYED ABOVE" \
        RETURN
2240 CLRTXWIN \ ETIME \ TXTSPOS(,9,28) \ PRINT "@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@"
2250 TXTSPOS(,14,18) \ PRINT "... TO THE COMPLETION OF STATIC LOADING"
2260 ETIME(X9) \ IF INT(X9)=1699 THEN ADIMMED(C,N6) \ ADIMMED(1,A5)
2265 T8=1701-X9 \ T8=INT(T8+.5) \ G=LEN(STR$(T8))
2270 TXTSPOS(,12,39-G) \ TXTINVERS \ PRINT T8;"s" \ TXTNORMAL \ ADIMMED(1,F0) \ IF F0>=.01
       THEN PRINT CHR$(7)
2280 IF T8>=1 THEN 2260
2290 F=99 \ GO TO 3330
2300 IF K6=-99 THEN IF A7=0 THEN 3330
2310 ETIME
2320 ETIME(K7) \ K6=600-K7 \ IF C0=98 THEN K6=600+K6
2330 IF K6<1 THEN K6=-99
2340 IF C0=98 THEN IF K6=-99 THEN GOSUB 4010 \ FGRESUME \ PRINT CHR$(7) \  REM Hold subr
        when time --> 0
2350 IF K6=-99 THEN 3330
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2360 K6=INT(K6+.5) \ G1=LEN(STR$(K6)) \ TXTSPOS(,5,40-G1) \ TXTINVERS \ PRINT K6;'s' \
        TXTNORMAL \ GO TO 2320
2370 TXTSCROLL(,1,24) \ CLRTXWIN \ ETIME \ TXTSPOS(,9,28) \ PRINT
        "@@@@@@@@@@@@@@@@@@@@@@@@@@"
2380 TXTSPOS(,14,21) \ PRINT "...TO THE COMPLETION OF THE TEST"
2390 ETIME(K9) \ K8=900-K9 \ K8=INT(K8+.5) \ G=LEN(STR$(K8))
2400 TXTSPOS(,12,39-G) \ TXTINVERS \ PRINT K8;"s" \ TXTNORMAL \ IF K8>=1 THEN 2390 \ RETURN
2410 TXTSPOS(,23,11) \ PRINT "TIME ELAPSED SINCE THE BEGINNING OF THE TEST:  ";\
        TXTSCROLL(,1,21)
2420 FOR J4=1 TO 3
2430 GTIME(S9,M9,H9) \ E9=((H9*60+M9)*60+S9)-((H8*60+M8)*60+S8)
2440 E8=INT(E9/3600) \ E7=INT((E9-E8*3600)/60) \ E6=E9-(E8*60+E7)*60
2450 E9$=STR$(E8)&"h "&STR$(E7)&"m "&STR$(E6)&"s " \ TXTSPOS(,23,58) \ TXTINVERS \ PRINT E9$;
2460 FOR I4=1 TO 882 \ NEXT I4
2470 TXTSPOS(,23,58) \ TXTEREOL \ NEXT J4
2480 IF C7>1 THEN TXTSPOS(,2,2)
2490 RETURN
2500 CLRTXWIN \ ETIME
2505 FOR I=1 TO 3 \ PRINT CHR$(7)CHR$(7); \ SLEEP(I-.5) \ NEXT I
2510 TXTSPOS(,5,13) \ TXTFLASH \ PRINT "THE SPECIFIED LIMITING STRAIN VALUE HAS BEEN
        EXCEEDED" \ TXTNORMAL
2520 TXTSPOS(,20,12) \ PRINT "RESTART TEST PROCEDURE USING THE LOAD VALUE LOWERED BY
        25%."
2530 TXTSPOS(,22,7) \ PRINT "IF YOU WISH TO RESTART NOW, JUST TYPE 'GO', IF NOT - ENTER 'N':";
        \ INPUT #0:R$
2540 IF R$='GO' THEN L1=.075*VAL(L$(1)) \ C2=C2+1 \ KBREMOVE \  FGREMOVE(1) \
        GO TO 3020
2550 IF R$<>'N' THEN 2530
2560 CLRTXWIN
2570 GO TO 4550
2580 FGIMMED(1,'R', TIME 1,0) \ FGSTOP \ ADSTOP \ GO TO 1870
2590 ADRMIN(1,R1,C) \ ADRMAX(2,R2,C) \ R3=99 \ ADINIT \ ADGO \ RETURN
2600 IF C0=98 THEN IF S0=21 THEN 3330
2610 IF C0=99 THEN IF S0=22 THEN C0=98 \ GOSUB 2110
2620 IF C0=98 THEN IF S0=22 THEN 2300
2630 GO TO 3330
2640 IF C0=0 THEN 2680
2650 IF C0=1 THEN IF M0=99 THEN 2680
2660 GO TO 3330
2670 IF C0=99 THEN 3330
2680 FOR I=1 TO 3 \ PRINT CHR$(7) \ FOR J=1 TO 200 \ NEXT J \ NEXT I
2690 C0=C0+1 \ K6=0 \ IF C0=1 THEN 3330
2700 GO TO 3330
2710 CLRTXWIN \ GO TO 3330
2720 IF O1=99 THEN 2840
2730 ADBURST(S1,C,1.00000E-03) \ ADINIT \ ADGO
2740 IF S1>=300 THEN 2770
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2750 GO TO 2740
2760 IF O1=99 THEN 2830
2770 CLRTXWIN \ GOSUB 2180
2780 FOR I=1 TO 300 \ S2(I)=10*ELEVEL(S1(I,1)) \ NEXT I
2790 I=I-5 \ S3=S2(I)
2800 FOR J=1 TO 4 \ S3=S3+S2(I+J) \ NEXT J
2810 S3=S3/5 \ D0=A7*Z3
2820 O1=99
2830 ADIMMED(C,N1) \ ADIMMED(1,A1) \ IF N1<Q1 THEN Q1=N1
2835 IF A1>U1 THEN U1=A1
2840 TXTSPOS(,15,27) \ IF S0=12 THEN TXTBOLD \ PRINT "NOW 10s LOADING IS UNDER WAY" \
       TXTNORMAL \ GO TO 2860
2850 TXTSPOS(,15,26) \ IF S0=8 THEN TXTBOLD \ PRINT "NOW 100s LOADING IS UNDER WAY" \
       TXTNORMAL
2860 GO TO 3330
2870 ADIMMED(C,N2) \ ADIMMED(1,A2) \ IF N2<Q2 THEN Q2=N2
2875 IF A2>U2 THEN U2=A2
2876 GO TO 3330
2880 ADIMMED(C,N3) \ ADIMMED(1,A3) \ IF N3<Q3 THEN Q3=N3
2885 IF A3>U3 THEN U3=A3
2886 TXTSPOS(,15,25) \ TXTEREOL \ GO TO 3330
2890 ADIMMED(C,N4) \ ADIMMED(1,A4) \ ADIMMED(C,A8) \  IF N4<Q4 THEN Q4=N4
2895 IF A4>U4 THEN U4=A4
2896 TXTSPOS(,15,25) \ TXTEREOL \ GO TO 3330
2900 TXTSPOS(,15,26) \ IF S0=4 THEN TXTBOLD \ PRINT "NOW 1000s LOADING IS UNDER WAY" \
       TXTNORMAL
2910 GO TO 3330
2920 IF T9>=1000 THEN 2990
2930 ETIME
2940 FOR I=1 TO 9
2950 ETIME(T9)
2960 IF T9<(3^(I-1))/30 THEN 2950
2970 ADIMMED(C,B2(I)) \ ADIMMED(1,B1(I)) \ NEXT I
2980 ETIME(T9) \ ADIMMED(C,B2(10)) \ ADIMMED(1,B1(10)) \ IF T9<1000 THEN 2980
2990 GO TO 3330
3000 IF F<>99 THEN 2240
3010 REM ADIMMED(C,N6) ...  ADIMMED(1,A5) ...  GO TO 3330
3020 DIM B1(10),B2(10),D1(6),H1(6),S1(300,1),S2(300),W(3,1),D7(10),R1(1,1),R2(1,1),B3(5),
       B7(6),M$(70),H2$(10),H3(10)
3025 DIM F3(6),F4(6),F5(5),F6(5),S(20,2)
3030 S0=0 \ S1=0 \ O1=0 \ F=0 \ M0=0 \ Z=0 \ T9=0 \ A7=0 \ C0=0 \ G0=0 \ X0=0 \ X1=0 \
     A=SYS(8)
3035 Q1=1.99 \ Q2=1.99 \ Q3=1.99 \ Q4=1.99 \ U1=-1 \ U2=-1 \ U3=-1\ U4=-1
3040 FGSTOP \ ADSTOP \ FGRESET \ CLRTXWIN \ CKTIME(1,2.00000E-03,C6)
3050 KBINT('K',6, LINE 1870 ) \ KBINT('B',5, LINE 4120 ) \ KBINT('S',4, LINE 2580 )
3060 KBINT('T',1, LINE 2410 ) \ KBENB
3070 IF C2>0 THEN L0=-L1 \ L1=L0 \ GO TO 3100
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3080 L0=-VAL(L$(1))/10 \ L1=L0 \ M1=VAL(L$(8)) \ Z1=10^6/VAL(L$(9)) \ Z2=VAL(L$(2)) \
        Z3=10*M1*Z1
3090 IF C0=0 THEN FGIMMED(1,'R', TIME 2,0)
3100 FGARB(1,'R', RATE .1,L0) \ FGRAMP(1,600,L0) \ FGARB(1,'R', RATE .1,0)
3110 FGRAMP(1,600,L0)
3120 FGRAMP(1,600,0) \ FGARB(1,'R', RATE 5,L0)
3130 FGARB(1,'SQ', TIME .1,L0) \ FGARB(1,'R', RATE 5,0) \ FGRAMP(1,60,0)
3140 FGARB(1,'R', RATE 5,L1) \ FGARB(1,'SQ', TIME 1,L1)
3150 FGARB(1,'R', RATE 5,0) \ FGRAMP(1,140,0) \ FGARB(1,'R', RATE 3,L1)
3160 FGARB(1,'SQ', TIME 10,L1) \ FGARB(1,'R', RATE 3,0) \ FGRAMP(1,320,0)
3170 FGARB(1,'R', RATE 2,L1) \ FGARB(1,'SQ', TIME 100,L1)
3180 FGARB(1,'R', RATE 2,0) \ FGRAMP(1,730,0) \ FGARB(1,'R', RATE 1,L1)
3190 FGRAMP(1,1000,L1) \ FGARB(1,'R', RATE 1,0) \ FGRAMP(1,1,0)
3200 IF C0>0 THEN 3280
3210 IF C2>0 THEN 3280
3220 TXTSPOS(,8,27) \ TXTBOLD \ PRINT "THIS IS A LOAD CONTROL TEST" \ TXTNORMAL
3230 TXTSPOS(,10,9) \ TXTINVERS \ PRINT "PLEASE, CHECK IF CONTROL IS TRANSFERRED TO A
        PROPER CONTROLLER" \ TXTNORMAL
3240 TXTSPOS(,12,21) \ PRINT "BE SURE ALL OTHER SETTINGS ARE CORRECT"
3250 TXTSPOS(,20,28) \ PRINT "IF READY - ENTER 'GO': "; \ INPUT #0:R$
3260 IF R$<>'GO' THEN 3250
3270 A=SYS(8) \ PRINT CHR$(27)&"(?25l" \ GTIME(S8,M8,H8)
3280 IF C0<>0 THEN 3310
3290 ADIMMED(1,S4) \ ADIMMED(C,S5) \ REM Just before the 1st cond load
3300 FGGO
3310 IF C0=1 THEN FGGO
3320 GOSUB 2110
3330 FGSTATUS(1,S0) \ IF S0=22 THEN IF C0=1 THEN 3040
3340 ADIMMED(C,B8) \ Z=(S5-B8)*Z3
3350 IF Z>Z2 THEN FGSTOP \ ADSTOP \ FGIMMED(1,'R', RATE .1,0) \ GO TO 2500
3360 IF S0=22 THEN IF C0=2 THEN C0=99
3370 D=26-S0 \ IF C0>2 THEN D=23-S0 \ IF S0=1 THEN 3000
3380 ON D GO TO 2600,3330,2640,2720,3330,2760,3330,3330,3330,2870,2840,3330,3330,2880,
        2850,3330,3330,2890,2900,2920,3330
3390 FGSTOP \ ADSTOP \ CLRTXWIN \ GOSUB 2210
3400 C3=0 \ C4=0 \ C7=0 \ F=0 \ R3=0
3410 T1=VAL(L$(3)) \ H=VAL(L$(4)) \ T0=.5*T1
3420 W(1,0)=T0 \ W(1,1)=-ABS(L1) \ W(2,0)=T0 \ W(2,1)=0 \ W(3,0)=H \ W(3,1)=0
3430 FGIMMED(1,'R', TIME 1,0) \ ETIME \ SLEEP(2) \ ADIMMED(C,A9) \ ADIMMED(1,F1)
3440 FGARB(1,'S', TIME , ARRAY W,,32767)
3450 FGARB(1,'S', TIME , BINARRAY W,,32767)
3460 FGBUFEND(1,, LINE 3600 )
3470 FGGO \ ETIME \ ETIME(T8) \ I=0 \ B9=0 \ TXTSPOS(,2,2) \ TXTINVERS \ GO TO 3490
3480 IF C7>C8 THEN 3570
3490 PRINT C7 \ TXTSPOS(,2,2) \ FGGCOUNTERS(1,C4,C3) \ C7=32767*(C4-25)+C3
3500 IF C7=10^I THEN ADIMMED(C,H1(I+1)) \ ADIMMED(1,D1(I+1)) \ GO TO 3480
3510 IF C7=200 THEN IF R3<>99 THEN GOSUB 2590
```

```
3520 IF C7=202 THEN IF B9<>999 THEN ADSTOP \ B9=999
3530 IF C7=10^I THEN 3480
3540 IF C7=C8-1 THEN ADIMMED(C,H1(6)) \ ADIMMED(1,D1(6)) \ GO TO 3480
3550 IF C7<10^(I+1) THEN 3480
3560 I=I+1 \ GO TO 3480
3570 ADSTOP \ TXTNORMAL \ FGIMMED(1,'R', TIME 1,0)
3580 ETIME \ SLEEP(1) \ FGIMMED(1,'SQ', TIME 900,0) \ GOSUB 2370
3590 ADIMMED(C,D4) \ ADIMMED(1,D3) \ GTIME(E7,E8,E9) \ GO TO 3610
3600 FGARB(1,'S', TIME , BINARRAY W,,32767) \ RETURN
3610 CLRTXWIN \ GOSUB 3690
3620 IF F9=>0 THEN IF F9<=1 THEN X1=.88
3630 KBREMOVE('S') \ KBREMOVE('T') \ PRINT CHR$(27)&"(?25h"
3640 PRINT TAB(10)"TEST COMPLETED  . . . . . * * * . . . . .  TEST COMPLETED"
3650 GOSUB 3980
3655 GO TO 4130
3690 G1=0 \ G2=0 \ G3=0 \ G4=0 \ P1=0 \ P2=0 \ P3=0 \ P4=0
3695 A1=U1 \ A2=U2 \ A3=U3 \ A4=U4
3700 A0=10*VAL(L$(6)) \  I4=A4*A0 \ A8=A8*Z3 \ F6(1)=ABS(A1-F0)*A0
3710 F6(2)=ABS(A2-F0)*A0 \ F6(3)=ABS(A3-F0)*A0 \ F6(4)=ABS(A4-F0)*A0 \ F6(5)=ABS(A5-F0)*A0
3730 FOR I=1 TO 10 \ B2(I)=INT(ABS(B2(I)*Z3-A8)+.5) \ B1(I)=ABS(B1(I)*A0-I4) \ NEXT I
3750 F1=F1*A0 \ A9=A9*Z3
3760 FOR I=1 TO 6 \ F3(I)=INT(ABS(H1(I)*Z3-A9)+.5) \ F4(I)=ABS(D1(I)*A0-F1) \ IF F3(I)=0 THEN
       F3(I)=1
3770 NEXT I
3780 D2=(ELEVEL(R2(1,1))-ELEVEL(R1(1,1)))*Z3 \ F7=ABS(D2) \ D2=INT(D2+.5) \  D3=D3*A0
3790 D5=ABS(D3-F0*A0) \ D3=ABS(D3-F1) \ D4=D4*Z3 \ D6=ABS(D4-D0) \ D6=INT(D6+.5)
3800 D4=ABS(D4-A9) \ D4=INT(D4+.5)
3810 FOR I=1 TO 300 \ S2(I)=S2(I)*M1*Z1 \ NEXT I
3815 N1=Q1 \ N2=Q2 \ N3=Q3 \ N4=Q4
3820 F5(1)=N1*Z3 \ F5(2)=N2*Z3 \ F5(3)=N3*Z3 \ F5(4)=N4*Z3 \ F5(5)=N6*Z3
3830 FOR I=1 TO 5 \ F5(I)=INT(ABS(F5(I)-D0)+.5) \ NEXT I
3850 L2=L1*40*VAL(L$(7)) \ L3=((VAL(J$(7)))^2)*PI \ L2=L2/L3
3860 FOR I=1 TO 10 \ D7(I)=ABS(INT((B2(I)/L2)+.5)) \ NEXT I
3870 FOR I=1 TO 5
3880 G1=G1+(I-1) \ G2=G2+LOG10(F3(I)) \ G3=G3+(I-1)^2 \ G4=G4+(I-1)*LOG10(F3(I))
3890 NEXT I
3900 G5=G4-(G1*G2/5) \ G6=G3-((G1^2)/5) \ G7=G5/G6 \ G8=(G2/5)-(G7*G1/5)
3910 FOR I=1 TO 5 \ B7(I)=F5(I) \ NEXT I
3920 FOR I=1 TO 5 \ IF B7(I)=0 THEN B7(I)=1
3930 P1=P1+(I-1) \ P2=P2+LOG10(B7(I)) \ P3=P3+(I-1)^2 \ P4=P4+(I-1)*LOG10(B7(I))
3940 NEXT I
3950 P5=P4-(P1*P2/5) \ P6=P3-((P1^2)/5) \ P7=P5/P6 \ P8=(P2/5)-(P7*P1/5)
3960 F8=G8*G7/F7 \ F9=1-G7 \ L8=P8*P7/F7 \ L9=1-P7
3970 F8=INT(F8*10000)/10000 \ F9=INT(F9*10000)/10000 \ L8=INT(L8*10000)/10000 \
       L9=INT(L9*10000)/10000 \ RETURN
3980 TXTSPOS(,22,31) \ PRINT "<ESC*K> TO CONTINUE "; \ ETIME
3990 ETIME(Z5) \ IF Z5<1800 THEN 3990
```

```
4000 DOSET(49) \ DOWRITE(49,0) \ DOCLEAR(49) \ RETURN
4010 FGHOLDEND \ CLRTXWIN \ TXTSPOS(,10,30) \ PRINT "R e s t i n g ..."
4012 TXTSPOS(,15,10) \ PRINT "LOAD GENERATION WILL BE RESUMED AUTOMATICALLY AFTER ";
4013 TXTBOLD \ PRINT "1800"; \ TXTNORMAL \ PRINT " s"
4014 TXTNORMAL \ TXTSPOS(,17,13) \ PRINT "( TO RESUME LOAD GENERATION IMMEDIATELY,
     PRESS ESC"B )"
4016 ADPKVAL(3,S,,C,3.00000E-03,1) \ REM STATIC phase
4018 ADINIT \ ADGO
4020 FOR I=1 TO 500 \ NEXT I
4030 ADIMMED(1,F0) \ ADIMMED(C,A7) \ IF F0>=.01 THEN PRINT CHR$(7) \ REM During
     specimen relaxation
4040 IF G0<>0 THEN 4060
4050 E1=S4-F0 \ E2=S5-A7 \ G0=-99 \ ETIME
4060 B4=S4-F0 \ B5=S5-A7 \ ETIME(T5)
4065 TXTSPOS(,15,62) \ TXTEREOL \ TXTSPOS(,15,62) \ TXTBOLD \ PRINT
     STR$(INT(1800-T5)); \TXTNORMAL \ PRINT " s"
4070 B4=B4/E1 \ B5=B5/E2 \ B4=ABS(INT(B4*10000)/100) \ B5=ABS(INT(B5*10000)/100)
4080 TXTSPOS(,12,5) \ TXTINVERS \ PRINT B4; \ TXTNORMAL
4090 PRINT " = stroke(%) . . . . . (%)strain = "; \ TXTINVERS
4100 PRINT B5 \ TXTNORMAL \ IF T5<1800 THEN 4020
4110 RETURN
4120 FGRESUME \ PRINT CHR$(7)CHR$(7) \ GO TO 2350 \ REM Interrupt to 'sleeping' subr
4130 CLRTXWIN \ IF X0=.99 THEN PRINT TAB(21)"TEST RESULTS ARE SAVED ALREADY!" \ INPUT #0:R$
     \ GO TO 1870
4140 OPEN "TSTC" AS FILE #1
4150 FOR I=1 TO 7 \ INPUT #1:H2$(I) \ INPUT #1:H3(I)
4160 IF H2$(I)="CCT" THEN H3(I)=H3(I)+1 \ T4=H3(I) \ F2$=STR$(T4)
4170 NEXT I
4180 CLOSE #1
4190 OPEN "TSTC" FOR OUTPUT AS FILE #1, FILESIZE 1
4200 FOR I=1 TO 7 \ PRINT #1:H2$(I) \ PRINT #1:H3(I) \ NEXT I
4210 CLOSE #1
4220 F2$="CCT"+F2$+".MTS" \ OPEN F2$ FOR OUTPUT AS FILE #2, FILESIZE 8, ERROR X8
4230 M$(1)=SEG$(J$(5),1,2)+"("+SEG$(J$(5),3,6)+")" \ M$(2)=STR$(T4) \
     M$(3)=V2$&"/"&V1$&"/"&V3$
4240 M$(4)=SEG$(J$(2),1,1)+"."+SEG$(J$(2),2,2)+"."+SEG$(J$(2),3,5)+"."+ SEG$(J$(2),6,7)+"."+
     SEG$(J$(2),8,10)
4250 M$(5)=SEG$(J$(3),1,2)+"/"+SEG$(J$(3),3,4)+"/"+SEG$(J$(3),5,6) \ M$(7)=J$(6) \ M$(8)=J$(7)
4255 M$(9)=SEG$(J$(1),1,4)+"."+SEG$(J$(1),5,7)+"."+SEG$(J$(1),8,10)
4260 M$(6)=SEG$(J$(4),1,1)+"-"+SEG$(J$(4),2,3)+"-"+SEG$(J$(4),4,6) \ M$(10)=J$(8) \
     M$(11)=J$(9)
4270 M$(12)=L$(7) \ M$(13)=L$(6) \ M$(14)=L$(8) \ M$(15)="0.0" \ M$(16)=L$(5) \ M$(17)=L$(10)
4280 Z6=INT(VAL(L$(1))*VAL(L$(7))+.5) \ M$(18)=STR$(Z6) \ M$(19)=STR$(VAL(L$(3))+
     VAL(L$(4)))
4290 M$(20)=L$(3) \ M$(21)=L$(9) \ M$(22)=STR$(D2) \ M$(23)=STR$(D5) \ M$(24)=STR$(D6)
4300 FOR I=25 TO 34 \ M$(I)=STR$(D7(I-24)) \ NEXT I
```

```
4310 M$(35)=STR$(F8) \ M$(36)=STR$(L8) \ M$(37)=STR$(F9) \ M$(38)=STR$(L9) \
       M$(39)=STR$(F5(1)) \ M$(40)=STR$(F5(2))
4320 M$(41)=STR$(F5(3)) \ M$(42)=STR$(F5(4)) \ M$(43)=STR$(F5(5))
4330 FOR I=44 TO 53 \ M$(I)=STR$(B2(I-43)) \ NEXT I
4340 M$(54)=STR$(D3) \ M$(55)=STR$(D4)
4350 FOR I=56 TO 61 \ M$(I)=STR$(F3(I-55)) \ NEXT I
4360 M$(62)=SEG$(M4$,1,32) \ M$(63)=SEG$(M4$,33,64) \ M$(64)=SEG$(M4$,65,96) \
       M$(65)=SEG$(M4$,97,127)
4370 FOR I=0 TO 65 \ PRINT #2,USING "<################################",M$(I) \ NEXT I \
       REM 32-char str
4380 PRINT #2,"{{0}}" \ CLOSE #2
4400 TXTSPOS(,10,18) \ TXTINVERS \ PRINT "TEST RESULTS SAVED IN FILE: ";F2$;
4410 X0=.99 \ TXTNORMAL \ INPUT #0:R$
4420 A=SYS(7) \ GO TO 1870
4430 V$="-#.###" \ TXTSPOS(,23,9) \ PRINT U$
4435 TXTSPOS(,23,22) \ TXTBOLD \ PRINT USING V$,L8
4440 TXTSPOS(,23,34) \ PRINT USING V$,F8 \ TXTSPOS(,23,55) \ PRINT USING V$,L9
4445 TXTSPOS(,23,67) \ PRINT USING V$,F9 \ TXTNORMAL
4450 PRINT TAB(6)"NOTES (<128 characters): ";
4460 INPUT #0:R$ \ IF R$="" THEN GO TO 4500
4470 M4$=M4$+R$ \ IF LEN(M4$)>=127 THEN GO TO 4490
4480 GO TO 4460
4490 PRINT TAB(22)"<CR> TO GET MENU, ANY OTHER - TO QUIT "; \ INPUT #0:R$
4500 IF R$<>"" THEN 1990
4510 GOTO 1870
4520 REM End of the routine
4550 A=SYS(7) \ END
```

EXAMPLE OF INPUT TO THE PROGRAM
and
CORRESPONDING TEST RESULTS

USER'S INPUT TO THE PROGRAM

SCREEN 1

```
                    SAMPLE IDENTIFICATION

(1)  PAVEMENT SAMPLE ID.(A999999X99):     A404221A07
(2)  SPECIMEN ID.(AAX99XA999):            PDA07AA221
(3)  DATE OF SAMPLE (MMDDYY):             081992
(4)  MIX DESIGN ID.(AA9999):              SH1000
(5)  TEST ID.(AA9999):                    CC0306
(6)  SPECIMEN HEIGHT (mm):                202
(7)  SPECIMEN DIAMETER (mm):              101.6
(8)  SPECIMEN MASS (kg):                  3
(9)  DISTANCE FROM PAVEM. EDGE (m):       0

                ANY CHANGES?(Y/N): N
```

SCREEN 2

```
                    TEST SPECIFICATIONS

(1)  COMPRESSIVE LOAD TO BE APPLIED (volts):          1.2
(2)  LIMITING STRAIN VALUE (microstrains):            2500
(3)  LOAD PULSE DURATION IN REPEATED LOADING (s):     .1
(4)  REST PERIOD IN REPEATED LOADING (s):             .9
(5)  TEST TEMPERATURE (C):                            40
(6)  STROKE CALIBRATION FACTOR (mm/Volt):             1.27
(7)  LOAD CALIBRATION FACTOR (Newton/Volt):           444.8
(8)  STRAIN CALIBRATION FACTOR (mm/Volt):             .095
(9)  SPACING BETWEEN LVDT CLAMPS (mm):                140
(10) TEST HUMIDITY (%):                               61

                ANY CHANGES?(Y/N): N
```

TEST RESULTS (WITH COMMENTS)

^PERMANENT^ DEFORMATION DUE TO REPETITIVE STATIC LOADING

LOAD TIME (s)	STROKE (mm)	STRAIN (mcstrains)
.1	-.0585522	10
1.0	-.0535112	30
10	-.0434294	70
100	-.0267556	132
1000	-1.55105E-03	207

ACCUMULATED DEFORMATION DURING 1000s STATIC LOADING

LOAD TIME (s)	STROKE (mm)	STRAIN (mcstrains)
.033	.0562256	183
.1	.0593277	202
.3	.0670829	234
.9	.0783281	283
2.7	.0918997	339
8.1	.101982	387
24.3	.112839	429
72.9	.122145	470
218.7	.131839	506
1000	.145023	561

Variables representing the values in two last columns

⇐ A1 ⇐ N1
⇐ A2 ⇐ N2
⇐ A3 ⇐ N3
⇐ A4 ⇐ N4
⇐ A5 ⇐ N6

⇐ B1(1) ⇐ B2(1)
⇐ B1(2) ⇐ B2(2)
⇐ B1(3) ⇐ B2(3)
⇐ B1(4) ⇐ B2(4)
⇐ B1(5) ⇐ B2(5)
⇐ B1(6) ⇐ B2(6)
⇐ B1(7) ⇐ B2(7)
⇐ B1(8) ⇐ B2(8)
⇐ B1(9) ⇐ B2(9)
⇐ B1(10) ⇐ B2(10)

TOTAL ^PERMANENT^ DEFORMATION DUE TO DYNAMIC HAVERSINE LOADING:

Stroke = .0593277 mm
Strain = 138 mcstrains

DEFORMATION MEASURED DURING HAVERSINE LOADING

NO.OF CYCLES	STROKE (mm)	STRAIN (mcstrains)
1	5.81643E-03	22
10	.0100818	45
100	.0190004	78
1000	.0321843	105
10000	.0632053	153

STRAIN AMPLITUDE AT 200th CYCLE OF HAVERSINE LOADING: 77 mcstrains

Total Permanent Deformation Due to the Test:

Stroke = .0585521 mm
Strain = 341 mcstrains

Variables representing the values shown
← D3
← D4

Variables representing the values in two last columns
⇐ D1(1) ⇐ H1(1)
⇐ D1(2) ⇐ H1(2)
⇐ D1(3) ⇐ H1(3)
⇐ D1(4) ⇐ H1(4)
⇐ D1(5) ⇐ H1(5)

Corresponding variables
← D2

← D5
← D6

STRAIN VALUES MEASURED DURING LOADING OVER .1s (microstrains)

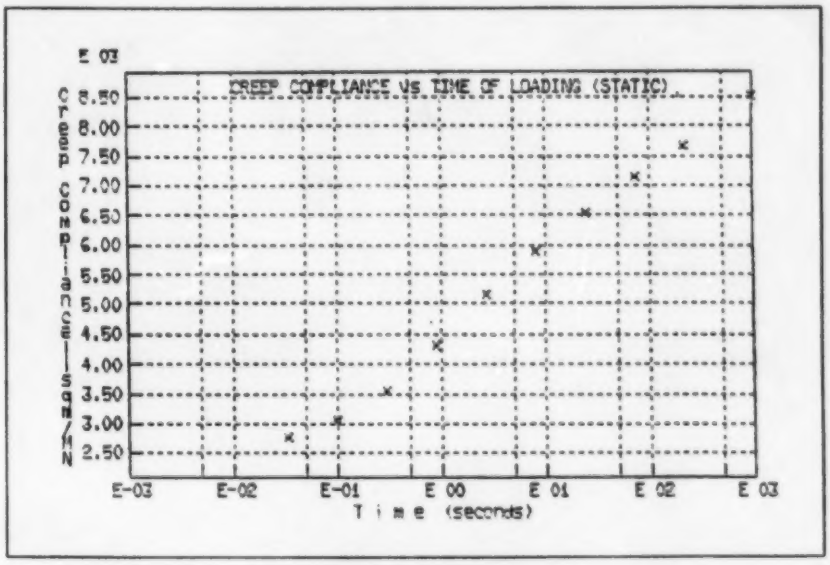
816.308	817.965	818.587	817.753	820.659	818.38
821.902	819.001	822.73	820.452	823.974	822.109
824.595	824.388	824.802	826.874	824.002	820.117
825.01	828.739	826.045	829.36	827.496	830.396
828.739	830.189	831.639	830.189	833.297	830.604
833.504	830.396	833.297	830.396	832.468	829.982
831.225	829.775	828.117	829.36	825.424	827.289
822.938	824.595	820.452	821.695	817.758	818.38
815.272	813.614	812.786	808.849	809.885	804.913
806.777	802.012	803.669	799.733	800.769	798.076
798.49	797.661	795.589	797.247	793.31	795.589
791.031	793.31	789.788	791.446	788.545	789.788
788.338	787.716	788.752	785.645	788.338	784.816
787.509	784.194	786.473	783.573	785.437	782.744
783.158	783.158	781.086	782.951	779.636	782.33
778.6	781.294	777.979	780.465	778.186	779.843
778.807	777.979	779.429	776.321	779.015	775.078
777.564	774.249	776.528	773.835	775.7	773.628
774.249	774.664	772.799	775.492	772.177	775.078
771.763	774.456	771.142	773.213	770.52	771.763
770.934	769.691	771.556	768.655	771.556	768.034
770.934	767.827	770.52	767.827	770.106	768.241
768.655	769.277	766.791	769.277	765.755	768.655
765.34	768.034	765.34	767.619	765.133	766.583
766.169	765.34	767.619	764.512	767.205	763.683
766.376	763.061	765.548	762.647	764.719	763.061
763.269	764.305	762.025	764.512	761.404	764.719
761.404	764.305	761.611	763.89	761.404	762.647
762.233	760.99	763.061	760.161	762.854	759.539
762.44	759.125	761.404	759.125	761.197	759.746
759.954	761.404	758.918	761.611	758.089	760.99
757.675	760.368	757.467	759.746	757.675	758.918
758.918	757.26	759.954	757.053	760.161	757.053
759.954	756.846	759.332	756.639	758.503	757.467
757.26	758.503	756.017	758.711	755.603	758.296
755.188	758.089	755.396	757.882	756.017	756.846
757.053	755.396	757.675	754.36	757.26	754.152
756.846	753.324	756.431	753.945	755.603	754.567
754.36	756.017	753.531	756.639	753.116	756.224
752.909	755.603	752.702	754.774	752.702	753.531
753.738	752.081	754.774	751.752	754.774	751.459
754.567	751.873	754.36	752.181	753.738	752.702
752.288	753.945	751.252	754.152	750.63	753.324
750.423	753.116	750.216	752.702	750.838	751.873
752.702	750.838	753.324	750.423	753.116	749.802
752.702	749.594	752.081	749.387	751.252	750.423
749.802	751.459	749.18	752.081	748.973	752.288
749.18	751.873	749.18	751.045	749.387	750.216
750.423	748.766	751.252	747.937	751.252	747.73
750.63	747.937	750.63	748.558	750.216	749.594

Array elements representing the tabulated data.

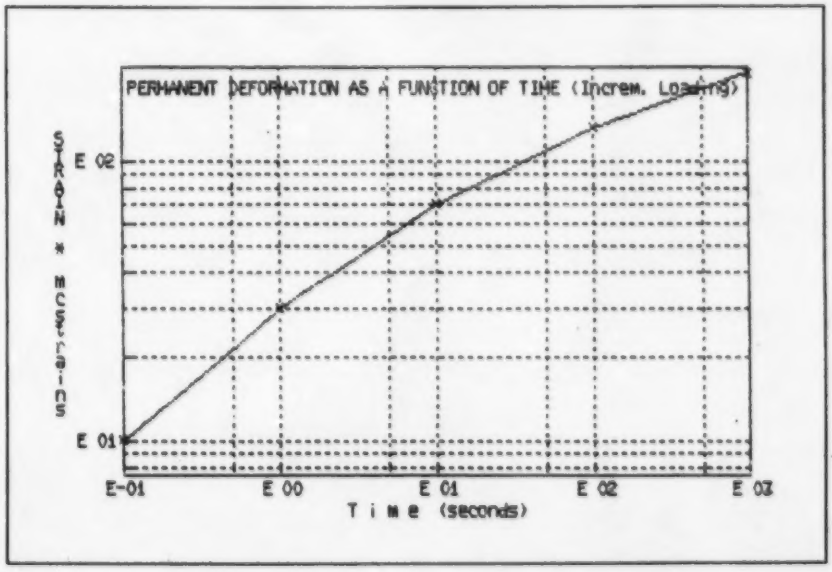
⇐ S2(1) ÷ S2(300)

These data points are collected at the rate of 1,000 per second.

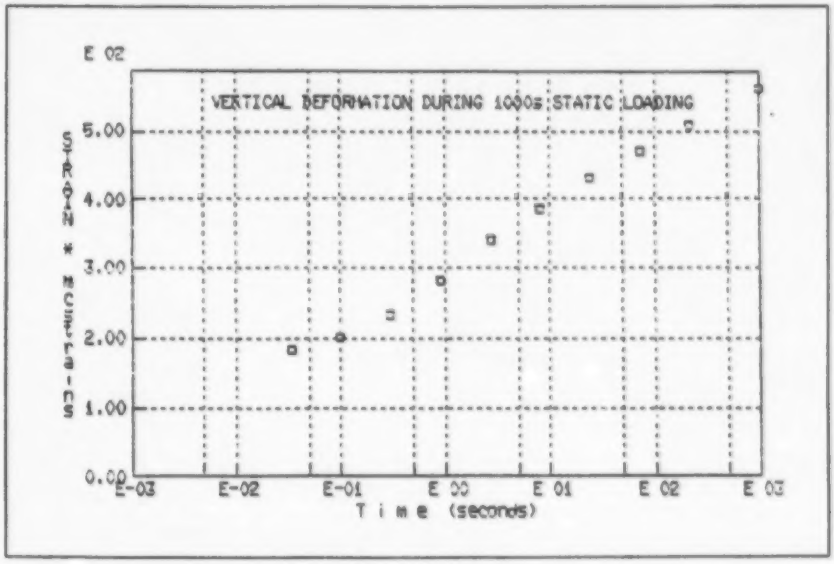
CREEP COMPLIANCE



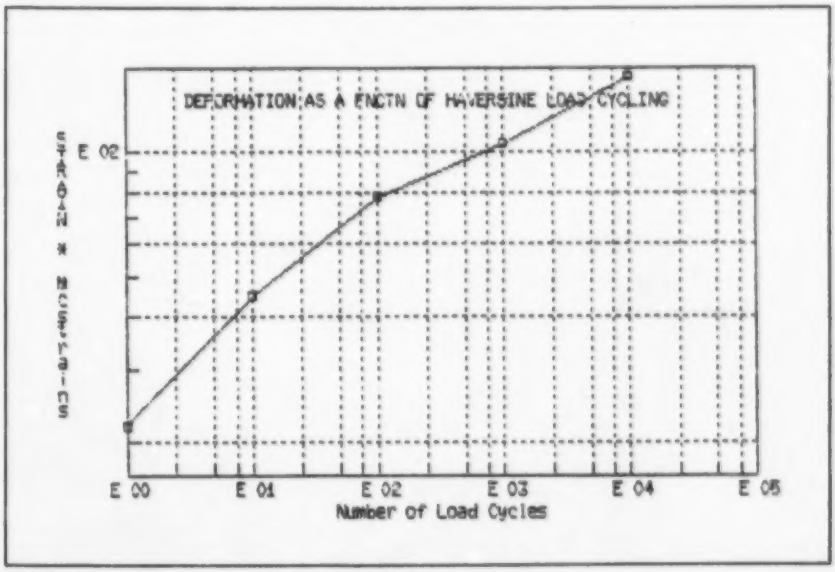
DEFORMATION - INCREMENTAL STATIC LOADING



DEFORMATION - 1,000 s STATIC LOADING



DEFORMATION - DYNAMIC REPETITIVE LOADING



TEST REPORT

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** CREEP COMPLIANCE TEST **                DATE OF TEST: 20-Aug-92
--------------------------                THURSDAY *  15 : 18 : 40
                                          TEST ID.: CC0306

SAMPLE IDENTIFICATION
1.PAVEMENT SAMPLE ID.: A404221A07    4.DATE OF SAMPLE:      081992
2.SPECIMEN ID.:        PDA07AA221    5.MIX DESIGN ID.:      SH1000
3.SPEC. HEIGHT (mm):   202           6.SPECIMEN DIA.(mm):   101.6

TEST PARAMETERS
   1.COMPRESSIVE LOAD (N):    534     4.TEST TEMPERATURE (C):40
   2.LOAD PULSE DURATION (s): .1      5.CLAMPS SPACING (mm): 140
   3.REST BETWEEN PULSES (s): .9

TEST RESULTS

   TSTATIC: .033,.1,.3,.9,2.7,8.1,24.3,72.9,218.7,1000
   CREEP COMPL.(m^2/N ), for each TSTATIC listed above:
            2.780 E+3   3.068 E+3   3.554 E+3   4.299 E+3   5.149 E+3
            5.878 E+3   6.516 E+3   7.139 E+3   7.686 E+3   8.521 E+3
   ALPHA:  stat= 0.005  dyn= 0.004    GNU:  stat= 0.672  dyn= 0.795
 NOTES (<128 characters): Top #2, 91-64, @ 40C.
```

Parameters used in the VESYSJA pavement analysis program